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PRELIMINARY DRAFT
(Not Yet Subjected to Peer Review)

SITES CONTAMINATED AND POTENTIALLY CONTAMINATED WITH RADIOACTIVITY IN THE UNITED STATES

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A CAUTIONARY NOTE TO READERS OF THIS DOCUMENT

Users of this report should be aware of a number of factors that require that the data it contains be used with caution.

The purpose of this scoping study, began in June 1990 and completed in February 1991, was to identify all sites in the United States contaminated or potentially contaminated with radioactivity. This initial scoping data was needed to support work related to development of residual radioactivity guidelines and criteria. The approach for the study was to identify and list all sites in the U.S. that may, either currently or at some time in the future, require the removal of radioactive contamination to a level that would allow unrestricted release. Therefore, the study sought to identify all sites where a problem might exist irrespective of whether or not a given site requires remediation at the present time. Most of the sites identified are potential rather than current problems.

For several reasons, the data on "number of sites" should be used with caution. Data available at the time of the study were used to determine if a given entity, e.g., Hanford Reservation, was counted as a single site or as a collection of many sites. Where detailed data were available, the entity was counted as the total number of sites within the entity. Where data were not available, the entity was counted as a single site. This approach avoids over-estimation of the total number of sites, but may under-estimate the number of sites (but not the total number of facilities). In addition to this issue, the data used in the study are almost two years old. New data on contaminated sites have been generated by federal agencies during the year since the draft report was written. This may affect the total number of sites (and facilities) that are currently or potentially contaminated.

A large number of sites were identified and listed based solely on the fact that they contain sealed sources. The integrity of sealed sources is generally very high and it is unlikely that sites listed on the basis of these sources will ever require remediation.

Finally, this report is a preliminary draft and has not received peer review.

- February 1992

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1. Summary and Introduction

1.1 PURPOSE AND SCOPE

The purposes of this study are (1) to identify sites in the United States contaminated and potentially contaminated with radioactive material and (2) to characterize the nature and extent of residual radioactivity, i.e., that which remains once readily removable sources of contamination have been removed.

It is the intent of the study to estimate the number of contaminated sites and to briefly characterize the magnitude and nature of the residual radioactivity. The sites include those under the control of Federal agencies, those licensed by the Nuclear Regulatory Commission and/or Agreement States, and those for which States are the cognizant regulatory authorities (State and private sites). Active and inactive sites are included, as are sites previously remediated when identifiable.

Detailed site characterizations are not included since it is beyond the intended purpose and scope of this report. In addition, for many categories of sites, detailed site characterization information is not yet available.

1.2 BACKGROUND

Thousands of sites throughout the United States are currently being used, or were formerly used, in the production of radioactive materials, or in the manufacturing of products that use or produce radioactive materials. Included are privately owned sites regulated by the States and/or Nuclear Regulatory Commission, and sites currently or formerly used in a variety of Federal programs. Eventually these sites will be decontaminated and released for unrestricted use.

Though Federal and State authorities have established interim decontamination guidance (refer to Exhibit 1-1), there is a need to establish uniform, comprehensive clean-up criteria. The USEPA Office of Radiation Programs is developing residual radioactivity criteria for the decontamination of these sites. To support this overall initiative, identification of sites, as well as information on existing and potential residual radioactivity, is required. This information is necessary to define the nature and extent of the problem, and to evaluate the costs and benefits of a broad range of alternative clean-up criteria. Key questions this information will help answer include:

- How many sites exist which may require decontamination and what is the nature and extent of the residual radioactivity?

- Is the contamination on-site or off-site? Is it moving? At what rate? In what direction?

- How should clean-up criteria be defined, i.e., should it be performance-based or prescriptive?

- Should clean-up criteria be specific for different sites because of differences in nature and extent of residual radioactivity? Future land use? Forms of institutional controls to be imposed on the site?

- Will or should prior decontamination efforts be required to meet standards yet to be adopted?

Over the last decade, scores of reports have addressed aspects of this overall issue. More recently, major environmental restoration initiatives have been undertaken by Federal authorities. This study is limited to a review and compilation of the material available from these reports and programs.

Exhibit 1-1

Partial List of Decontamination and Decommissioning Guidance Documents

1. U.S. Atomic Energy Commission, Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors" (6/74)

2. American National Standards Institute, Draft American National Standard ANSI 13.12 (Draft), "Control of Radioactive Surface Contamination on Materials, Equipment, and Facilities to be Released for Uncontrolled Use" (8/78)

3. U.S. Nuclear Regulatory Commission, E. F. Conti, Draft Report NUREG-0613, "Residual Radioactivity Limits for Decommissioning" (1979)

4. Shilling, A. S., H. E. Lippek, P. D. Tegler, J. D. Easterling, NUREG/CR-0671, "Decommissioning Commercial Nuclear Facilities: A Review and Analysis of Current Regulations" (1979)

5. U.S. Nuclear Regulatory Commission, "Standards for Protection Against Radiation", 10 CFR 20 (1981)

6. U.S. Nuclear Regulatory Commission, Division of Fuel Cycle and Material Safety, "Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of License for Byproduct, Source, or Special Nuclear Material" (7/82)

7. U.S. Department of Energy, "Guidelines for Residual Radioactive Material at Formerly Utilized Sites Remedial Action Program and Remote Surplus Facilities Management Program Sites", Revision 2 (3/87)

1.3 KEY DEFINITIONS

It is important to understand the distinction between the following key words in order to properly portray the results and limitations of the study. An augmented list of key terms is in the Appendix.

- Facility - An installation or landholding encompassing all contiguous land owned by a department of the Federal government, NRC/Agreement State licensee or private entity. Facilities may be complex, containing many buildings and covering a wide area.

- Site - A contaminated site is a discrete, physically separate parcel of land containing or potentially containing radioactive material in concentrations greater than those naturally occurring. A site is usually a portion of a facility.

For purposes of identifying sites, the significance of these definitions is best illustrated by considering the Hanford Reservation, a Department of Energy complex in the State of Washington. The Hanford Reservation is a single facility per the definition above. However, Hanford has 78 distinct major components (i.e., building complexes called "operable units") within its borders. At Hanford, each operable unit has an average of approximately 20 potentially contaminated sites for a total of approximately 1560 sites.[33] Each site is expected to be the object of a site characterization and decontamination effort. When information on discrete, physically separate parcels of land within a facility was available, the facility was decomposed into as many sites as the data supported. When information was not available, the facility was counted as a single site. This approach was taken to avoid over estimating the number of sites.

1.4 DESCRIPTION OF STUDY

This work is an effort to understand the nature and extent of radioactive contamination in the United States. The study identifies the number of facilities and sites potentially contaminated with radioactive material and lists, in one place, the sources of information that characterize the nature and extent of radioactive contamination at facilities and sites in the United States and its territories.

The study is based on readily available, published information. In addition, many of the authors of the published information were contacted to obtain updated information. The managers of major Federal programs and Federal agency environmental managers were also contacted to obtain the most current information on their programs and the results of site identification and characterization programs to date.

Chapter 2, Identification of Sites, identifies the number and types of sites, their locations, and the entities responsible for either clean-up or regulatory oversight. Chapter 3 presents a brief overview of the nature of the residual radioactivity at the various sites and discusses data gaps which need to be filled.

Definitions used in this report are listed in the Appendix. The Reference section lists reference material and the personnel contacts who provided important input and guidance for this report. The authors of the reference documents were very helpful in updating information contained in the documents. Similarly, the employees at various Federal, State and private entities were, as a group, very helpful. Those listed were particularly helpful and deserve special mention.

1.5 SUMMARY

1.5.1 Identification of Sites

Currently, a minimum of over 45,300 sites handle radioactive material or contain potential radioactive contamination as shown in Summary Exhibit 1-2. Of these, approximately half are in operation today. In some cases, a single complex may have as many as 1500 contaminated sites, in other cases there may be one site per complex.

The residual radioactivity ranges from levels approximating natural background to highly radioactive liquids and solids. As a category, the most radioactive sites are owned by the Federal government, primarily the Departments of Defense and Energy.

Not included in the total are approximately 1.5 million sites (oil/gas wells and coal-fired boilers) potentially contaminated with naturally occurring radioactive material (NORM).

Exhibit 1-2

Number of Sites with Potential Residual Radioactivity, by Cognizant Entity

Entity	Number
Federal Agencies	19,945
NRC/Agreement State Licensees	18,902
States	6,514
Total	45,361

1.5.2 Types, Locations, and Numbers of Sites

Sites contaminated and potentially contaminated with radioactive materials are located in all 50 States, the District of Columbia and in most, if not all, United States Territories. Summary Exhibit 1-3 organizes the total number of sites according to cognizant authority, State, and EPA Region.

Exhibit 1-3, which presents the number of sites and their distribution, is incomplete because it is based on incomplete information. However, the numbers presented are believed to be minimums since information on discrete land parcels (sites) was not always available from large complex facilities, and such facilities are believed to contain scores of sites. The main text of this report describes some of the challenges encountered and assumptions used to construct the summary tables provided throughout the report.

1.5.3 Extent and Nature of Residual Radioactivity

Summary Exhibit 1-4 identifies the waste type(s) that are sources of residual radioactivity at the sites identified. The sources noted range from highly radioactive spent reactor fuel to relatively high concentrations of naturally occurring radioactive material.[HR-27] Refer to the Appendix for information describing each waste type.

Exhibit 1-3

Number of Sites with Potential Residual Radioactivity, by Site Type, Location and Cognizant Entity (1,2)**

SITE TYPE (3)	TOTAL	EPA REGION 1						EPA REGION 2				EPA REGION 3						EPA REGION 4								EPA REGION 5					
		CT	ME	MA	NH*	RI*	VT	NJ	NY*	PR	VI	DE	DC	MD*	PA	VA	WV	AL*	FL*	GA*	KY*	MS*	NC*	SC*	TN*	IL*	IN	MI	MN	OH	WI
FEDERAL SITES																															
Army Corps of Engineers (9)	14	-	-	1	-	-	-	-	1	-	-	-	-	2	-	-	-	1	-	1	1	1	-	-	-	-	-	-	-	-	-
CIA (4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Agriculture	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Commerce (5,9)	23	1	-	1	-	-	-	1	1	1	-	-	-	2	-	1	-	-	1	-	-	1	1	2	-	-	-	2	-	-	-
Dept of Defense (6)	7463	563	22	584	22	-	-	87	87	-	-	-	108	325	22	628	-	87	43	130	65	22	65	43	22	87	65	43	-	87	-
Dept of Energy (7,8)	11984	41	-	124	-	-	-	330	455	2	-	-	-	41	288	-	-	-	41	-	41	-	-	83	251	291	41	41	-	332	-
Dept of Health/Human Services	46	-	-	1	-	-	-	-	2	3	-	-	2	7	1	-	1	1	-	2	-	-	1	-	-	-	-	1	1	2	-
Dept of Interior (9)	88	-	-	1	-	-	-	-	1	1	-	-	-	1	2	3	1	2	1	1	-	1	1	-	-	1	1	1	1	-	1
Dept of Justice (9)	4	-	-	-	-	-	-	-	-	1	-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Labor (9)	7	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	1	-	-	1	-
Dept of Transportation (9)	15	2	-	2	-	-	-	2	1	-	-	-	-	-	-	3	-	-	1	-	-	1		-	-	-	-	-	-	-	-
Dept of the Treasury (9)	3	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EPA (9,10)	73	-	-	1	-	1	-	7	4	-	-	-	-	1	1	-	1	1	3	1	1	1	1	1	1	6	1	1	1	3	-
Government Services Adm	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NASA	13	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	1	1	-	-	1	-	-	-	-	-	-	-	5	-
Postal Service (11)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Small Business Administration	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TVA (12)	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	13	-	-	-	-	-	-
Veterans Administration	121	2	1	-	1	1	1	2	9	1	-	1	1	3	5	3	4	-	4	3	2	2	4	2	4	5	-	5	1	4	2
SUBTOTALS: STATE	19945	609	23	714	23	2	1	423	558	9	0	1	113	386	320	642	8	101	93	138	109	30	73	130	290	386	108	94	4	432	3
REGION	19071						1372				990						1470								964						1027

* Agreement State

** Numbers in parentheses refer to notes on page 10.

Exhibit 1-3 (Continued)

SITE TYPE (3)	TOTAL	EPA REGION 6					EPA REGION 7				EPA REGION 8						EPA REGION 9						EPA REGION 10			
		AR*	LA*	NM*	OK	TX*	IA*	KS*	MO	NE*	CO*	MT	ND*	SD	UT*	WY	AS	AZ*	CA*	GU	HI	NV*	AK	ID*	OR*	WA*
FEDERAL SITES																										
Army Corps of Engineers (9)	14	1	-	-	2	1	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CIA (4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Agriculture	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Commerce (5,9)	23	-	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	-	1	-	-	2
Dept of Defense (6)	7463	87	87	173	22	303	22	43	108	-	108	-	22	22	87	22	-	43	952	537	88	44	43	-	43	1169
Dept of Energy (7,8)	11984	-	-	354	-	49	41	-	208	1	5100	-	10	138	211	42	-	14	209	-	-	810	-	129	50	1684
Dept of Health/Human Services	46	1	3	1	1	1	-	-	2	-	1	2	-	1	-	-	-	3	2	-	-	-	1	-	-	2
Dept of Interior (9)	88	1	-	9	3	1	-	1	1	-	9	1	1	1	6	1	-	9	3	-	-	2	1	4	7	6
Dept of Justice (9)	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Labor (9)	7	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Dept of Transportation (9)	15	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Dept of the Treasury (9)	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
EPA (9,10)	73	-	-	2	2	2	-	1	4	-	6	-	-	-	2	-	-	-	4	-	-	2	-	1	3	6
Government Services Adm	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NASA	13	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Postal Service (11)	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Small Business Administration	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TVA (12)	22	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Veterans Administration	121	-	3	1	2	6	2	3	3	3	1	1	1	3	1	-	-	-	10	-	-	2	-	1	2	3
SUBTOTALS: STATE	19945	90	93	538	32	366	65	48	322	5	5226	4	34	166	306	65	0	69	1181	537	88	860	46	134	104	2869
REGION	19071					1119				440						5801						2735				3153

Exhibit 1-3 (Continued)

SITE TYPE (3)	TOTAL	EPA REGION 1						EPA REGION 2				EPA REGION 3						EPA REGION 4								EPA REGION 5					
		CT	ME	MA	NH*	RI*	VT	NJ	NY*	PR	VI	DE	DC	MD*	PA	VA	WV	AL*	FL*	GA*	KY*	MS*	NC*	SC*	TN*	IL*	IN	MI	MN	OH	WI
HOSPITAL/MEDICAL CTRS (9,13)	5837	76	32	124	36	24	16	164	262	40	1	16	26	120	312	114	48	115	414	183	84	99	137	60	163	229	123	255	58	236	85
MANUFACTURING PLANTS (9,14)	10207	25	35	277	47	37	6	114	341	5	1	8	-	370	176	53	3	282	535	289	229	201	30	141	266	672	90	19	57	46	228
NON-DEFENSE RESEARCH LABS	2613	36	21	68	26	10	12	46	137	20	2	14	19	62	95	52	20	41	99	58	34	24	67	75	56	129	39	96	37	75	50
NUCLEAR POWER REACTORS (15)	110	4	1	2	1	-	1	4	7	-	-	1	-	3	9	4	-	5	5	4	-	1	5	7	4	13	-	5	3	2	3
NUCLEAR RESEARCH REACTORS	71	-	-	1	-	-	-	1	4	-	-	1	3	3	6	5	1	-	-	2	-	-	2	-	1	2	-	-	-	7	1
URANIUM FUEL CYCLE (16)	46	1	-	-	-	1	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	1	2	1	-	-	-	-	-
WASTE MANAGEMENT	18	1	1	1	-	-	-	1	1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1	1	2	-	1	-	-	-
SUBTOTALS: STATE	18902	143	90	473	110	72	35	330	752	65	4	40	48	558	600	229	72	438	1053	536	347	325	243	285	489	1048	252	376	155	366	367
REGION	18889						923				1151						1547								3716						2564
STATES																															
MANUFACTURING (17)	118	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	-	-	-	1	6	-	3	8	-	-	-	-	-
MINING	3845	-	-	-	-	-	-	1	2	-	-	2	-	2	1	-	-	1	43	1	2	2	4	1	4	2	1	1	1	5	-
OIL & GAS PRODUCTION (18)	1.5 Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
POWER PLANTS (18)	52400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RESEARCH	1850	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER TREATMENT (19)	700	3	-	-	-	-	-	6	-	-	-	-	-	1	3	2	-	-	2	50	-	3	50	50	-	75	-	1	10	-	60
OTHER (20)	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTALS: STATE	6514	3	0	0	0	0	0	7	3	0	0	2	0	3	4	2	0	23	45	51	2	6	60	51	7	85	1	2	11	5	60
REGION	4451						3				10						11								245						164
TOTALS: STATE	45361	755	113	1187	133	74	36	760	1313	74	4	43	161	947	924	873	80	562	1191	725	458	361	376	466	786	1519	361	472	170	803	430
REGION	42411						2298				2151						3028								4925						3755

Exhibit 1-3 (Continued)

SITE TYPE (3)	TOTAL	EPA REGION 6					EPA REGION 7				EPA REGION 8						EPA REGION 9						EPA REGION 10			
		AR*	LA*	NM*	OK	TX*	IA*	KS*	MO	NE*	CO*	MT	ND*	SD	UT*	WY	AS	AZ*	CA*	GU	HI	NV*	AK	ID*	OR*	WA*
HOSPITAL/MEDICAL CTRS (9,13)	5837	103	139	33	70	515	46	87	120	39	62	24	30	13	29	18	-	81	544	1	21	26	8	22	54	100
MANUFACTURING PLANTS (9,14)	10207	137	288	223	299	1061	132	165	40	98	361	3	78	2	168	251	-	220	1405	-	2	87	21	96	218	256
NON-DEFENSE RESEARCH LABS	2613	18	35	32	31	131	53	39	51	22	67	16	16	10	30	7	1	41	281	1	14	18	11	24	37	107
NUCLEAR POWER REACTORS (15)	110	2	2	-	-	4	1	1	1	2	1	-	-	-	-	-	-	3	6	-	-	-	-	-	1	1
NUCLEAR RESEARCH REACTORS	71	1	-	-	2	1	-	1	1	-	-	-	-	-	-	1	-	-	22	-	-	1	-	-	1	-
URANIUM FUEL CYCLE (16)	46	-	-	6	1	3	-	-	1	-	8	-	-	1	4	9	-	-	1	-	-	-	-	-	-	3
WASTE MANAGEMENT	18	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	1
SUBTOTALS: STATE	18902	261	464	294	403	1716	232	293	214	162	499	43	124	26	231	286	1	345	2260	2	37	134	40	142	311	468
REGION	18889					3138				901						1209						2779				961
STATES																										
MANUFACTURING (17)	118	1	7	-	-	7	3	-	3	-	-	1	-	-	1	1	-	-	-	-	-	-	-	8	-	-
MINING	3845	2	1	243	4	57	-	-	1	-	1331	21	13	148	1146	342	-	332	30	-	-	25	5	21	7	27
OIL & GAS PRODUCTION (18)	1.5 Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
POWER PLANTS (18)	52400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RESEARCH	1850	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER TREATMENT (19)	700	-	-	4	1	5	120	6	50	10	10	-	-	-	10	3	-	10	1	-	-	-	-	-	-	-
OTHER (20)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SUBTOTALS: STATE	6514	3	8	247	5	69	123	6	54	10	1341	22	13	148	1157	346	0	342	31	0	0	25	5	29	7	27
REGION	4451					332				193						3027						398				68
TOTALS: STATE	45361	354	565	1079	440	2151	420	347	590	177	7066	69	171	340	1694	697	1	756	3472	539	125	1019	91	305	422	3364
REGION	42411					4589				1534						10037						5912				4182

Exhibit 1-3 (Continued)

NOTES:

(1) Dashes signify either that no State-specific data were available, that no rational basis existed for placing sites within specific States, or that no site is located within the State.

(2) In instances where information was not available on location, the sites were included in the "Total" column. Consequently the two numbers shown at the bottom of the "Total" column will not match until all State data can be obtained.

(3) Three basic categories of sites have been identified: Federal Sites, NRC/Agreement State Sites, and State Sites. Federal Sites are those owned and operated, or otherwise under the authority of the Federal government. NRC/Agreement State sites are those civilian and non-DoE Federal sites that require a regulatory program to assure they will be operated in a manner protecting public health and safety. State Sites are all other sites whose operation may result in residual radioactivity.

(4) The number of sites could not be determined from readily available sources of information.

(5) Study underway currently to inventory potential sites with residual radioactivity. Results are expected in late 1990.

(6) The distribution within States of all sites could not be determined from readily available information. Information on the distribution of approximately 7100 formerly utilized defense sites is being sought from the Army Corps of Engineers. For the present, the sites were distributed in proportion to the number of defense complexes in each State.

(7) The distribution within States of approximately 3900 Environmental Restoration remedial action sites could not be determined from readily available information. For the present, the sites were distributed in proportion to the number of DoE complexes in each State. Complexes for which sites have already been identified, e.g., the Uranium Mill Tailings Program and the Hanford Reservation, were excluded from the ratio process.

(8) Approximately 5600 sites of the total shown are related to uranium mill tailings.

Exhibit 1-3 (Continued)

NOTES:

(9) The majority of sites utilize instruments and/or measuring devices with sealed radioactive sources, thus significant residual radioactivity is not expected.

(10) The majority of sites shown are not EPA's direct responsibility, rather EPA retains a management role through Superfund legislation. The totals contain 6 former DoD sites but exclude all UMTRA Program sites.

(11) Although this site is contaminated with mill tailings, it is an active site, therefore not included in the UMTRA Program.

(12) Totals include 9 nuclear power plants not counted in the category "Nuclear Power Plants" under NRC/Agreement States.

(13) Totals do not include about an equal number of nuclear medical vans, veterinary sites, etc, licensed by or registered with the States. The number and location of such sites could not be determined from readily available information.

(14) The total represents a combination of NRC/Agreement State and State licensees because, for the most part, available information would not allow segregation.

(15) The total includes plants under active construction as of 12/88 minus the TVA units which are listed under Federal Sites/TVA.

(16) Enrichment and Fuel Processing Sites are included under Federal Sites/DoE.

(17) These sites are included under NRC/Agreement States/Manufacturing Plants. Available data would not allow segregation.

(18) Not included in totals to avoid obscuring results.

(19) Values shown represent the number of affected water treatment systems averaged over the number of states in that region.

(20) This category represents sites once licensed by the Atomic Energy Commission (AEC, predecessor to the Nuclear Regulatory Commission) or Agreement States that have since reverted back to the States. The site listed represents the low-level radioactive waste disposal portion of the West Valley site now under the management of New York State.

Exhibit 1-4

Sites with Potential Residual Radioactivity, by Site Type and Contaminating Waste Type

SITE TYPE	WASTE TYPES: SPENT FUEL	HIGH LEVEL	TRANS-URANIC	LOW LEVEL: GREATER THAN CLASS C	LOW LEVEL: CLASS A,B,C	MIXED	URANIUM: MILL TAILINGS	NARM: ACCELERATOR PRODUCED	NARM: NORM
FEDERAL SITES									
Army Corps of Engineers	-	-	-	-	X	-	-	-	-
Dept of Agriculture	-	-	-	-	X	-	-	-	-
Dept of Commerce	-	-	-	X	X	-	-	X	-
Dept of Defense	X	X	X	X	X	X	-	X	X
Dept of Energy	X	X	X	X	X	X	X	X	X
Dept of Health & Human Services	-	-	-	-	X	-	-	X	-
Dept of Interior	X	-	-	X	X	X	X	-	X
Dept of Justice	-	-	-	-	X	-	-	-	-
Dept of Labor	-	-	-	-	X	-	-	-	-
Dept of Transportation	-	-	-	-	X	-	-	-	-
Dept of the Treasury	-	-	-	-	X	-	-	-	-
EPA	-	-	X	-	X	X	X	-	X
General Services Adm	-	-	-	-	-	-	-	-	X
NASA	-	-	-	X	X	-	-	X	-
Postal Service	-	-	-	-	X	-	-	-	-
TVA	X	-	-	X	X	X	X	-	X
Veterans Adm	X	-	-	X	X	-	-	X	-
NRC/AGREEMENT STATES									
Medical Sites	-	-	-	X	X	-	-	X	-
Manufacturing Plants	-	-	X	X	X	-	-	-	-
Non-Defense Research Labs	-	-	-	X	X	-	-	X	X
Nuclear Power Reactors	X	-	X	X	X	X	-	-	-
Nuclear Research & Test Reactors	X	-	X	X	X	X	-	-	-
Uranium Fuel Cycle Facilities	X	X	X	X	X	X	X	-	X
Waste Management	X	X	X	X	X	X	-	-	-
STATES									
Manufacturing	-	-	-	-	X	-	-	-	X
Mining	-	-	-	-	-	X	-	-	X
Oil & Gas Production	-	-	-	-	-	-	-	-	X
Power Plants (Non-Nuclear)	-	-	-	-	-	-	-	-	X
Research	-	-	-	-	-	-	-	X	-
Water Treatment	-	-	-	-	-	-	-	-	X
Other	-	-	-	-	X	-	-	-	-

2. Identification of Sites

Sites are identified and organized primarily according to type, location and cognizant authority. This approach was selected to group sites in a way in which remedial programs, budgets, etc., would be managed. Three basic categories of sites have been identified: Federal sites, sites licensed by the Nuclear Regulatory Commission (NRC) and/or by NRC Agreement States, and individual sites in the 50 States and U.S. Territories not covered by NRC/Agreement State authority. Within each major category, site types are further divided into the various categories of licensees (e.g., nuclear power plant licensees) or Federal agencies and programs. All sites are tabulated by EPA region.

In many cases, sites fall into more than one category. In an effort to avoid double counting, sites are tabulated in one of the three basic categories. When faced with such choices, the decision was always to include the site within the category with primary responsibility for operating or managing the site, using footnotes to assure reader clarity. For example, a nuclear power plant operated by the Tennessee Valley Authority (TVA) is tabulated under the TVA segment of Federal Agency Sites (Section 2.1) even though it would also fit logically in Section 2.2, NRC/Agreement State Sites.

Where it was impractical to list those entities with primary responsibility for operating or managing a site, subcategories were created to group similar sites. Thus a subcategory exists for nuclear power reactors rather than a listing of all reactor owners.

2.1 FEDERAL AGENCY SITES

Sites within this category are owned and operated, or are otherwise under the authority of agencies of the Federal government. Included are military bases, national research laboratories, weapons complexes, radioactive materials production systems, and a host of less prominent buildings and equipment. Such facilities include hospitals, schools, testing

ranges, reactors, accelerators, enrichment equipment, storage depots, and waste burial grounds (i.e., potential sites).

These sites are identified and described briefly below. Also summarized is the nature of the residual radioactivity known to exist or anticipated. For the purposes of this report, the listing contains sites previously decontaminated. This is done to allow future assessment of the acceptability of standards in use many years ago. Exhibit 2-1 presents a tabulation by site type, location, and cognizant agency of the 19,945 Federal sites identified. Each site category identified in Exhibit 2-1 is described briefly below in the order shown in the exhibit.

2.1.1 Army Corps of Engineers (CoE)[40]

The Army Corps of Engineers is responsible for various sites that utilize radioactive materials. Fourteen sites located in 12 states are under the CoE jurisdiction. Little, if any, residual radioactivity is expected at these sites due to the use of measuring instruments with sealed radioactive sources.

2.1.2 Department of Agriculture (DoA)[7,40]

The DoA's Agriculture Research Center in Beltsville, Maryland is reported to have used radioactive materials in simulating the effects of atomic weapons fallout on crops. Similar tests were also carried out at military bases wherein short-lived radionuclides were dispersed on land, buildings, vehicles, crops and roads to assess various removal methods. Since the radionuclides used are relatively short lived, no residual radioactivity is expected at these sites. Aside from a research site in Hyattsville, Maryland, the Beltsville site appears to be the only potentially contaminated DoA site.

Exhibit 2-1

Number of Federal Sites with Potential Residual Radioactivity, by Site Type, Location and Cognizant Entity (1,2)**

FEDERAL AGENCY (3)	TOTAL	EPA REGION 1						EPA REGION 2				EPA REGION 3						EPA REGION 4								EPA REGION 5					
		CT	ME	MA	NH*	RI*	VT	NJ	NY*	PR	VI	DE	DC	MD*	PA	VA	WV	AL*	FL*	GA*	KY*	MS*	NC*	SC*	TN*	IL*	IN	MI	MN	OH	WI
Army Corps of Engineers	14	-	-	1	-	-	-	-	1	-	-	-	-	2	-	-	-	1	-	1	1	1	-	-	-	-	-	-	-	-	-
CIA (4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Agriculture	2	-	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Commerce (5)	23	1	-	1	-	-	-	1	1	1	-	-	-	2	-	1	-	-	1	-	-	1	1	2	-	-	-	2	-	-	-
Dept of Defense																															
DERP (Active)																															
Bases (6)	103	1	1	-	1	-	-	2	4	-	-	-	3	10	1	2	-	4	1	3	2	1	2	1	1	3	2	1	-	1	-
Power Production	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Propulsion (7)	174	25	-	25	-	-	-	-	-	-	-	-	-	-	-	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Research Labs	19	-	-	2	-	-	-	-	-	-	-	-	2	4	-	1	-	-	-	2	-	-	-	-	-	1	-	1	-	1	-
Weapons Testing	14	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weapons Accidents (8)	29	-	-	-	-	-	-	2	-	-	-	-	-	1	-	-	-	-	1	1	1	-	1	1	-	-	1	-	-	2	-
DERP/FUDS (Inactive) (9)	7118	537	21	557	21	-	-	83	83	-	-	-	103	310	21	599	-	83	41	124	62	21	62	41	21	83	62	41	-	83	-
Dept of Energy																															
WMO (Active)																															
Diversified Labs (10)	1573	-	-	-	-	-	-	-	2	-	-	-	-	-	1	-	-	-	-	-	-	-	-	1	1	1	-	-	-	1	-
Materials Production	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	3	-
Weapons Production/Test	776	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-	-	-	-	1	-
Physical Research	4	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-
Miscellaneous	7	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
ER (Inactive)																															
ER (Remedial Action)(11)	3920	40	-	121	-	-	-	323	445	-	-	-	-	40	121	-	-	-	40	-	40	-	-	81	242	283	40	40	-	323	-
FUSRAP	31	1	-	2	-	-	-	6	6	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	1	3	-	1	-	-	-
GJRAP (12)	593	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SFMP (11)	36	-	-	-	-	-	-	-	1	2	-	-	-	-	1	-	-	-	-	-	-	-	-	1	5	2	-	-	-	4	-
UMTRAP (13)	5039	-	-	-	-	-	-	-	-	-	-	-	-	-	164	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* Agreement State

** Numbers in parentheses refer to notes on page 18.

Exhibit 2-1 (Continued)

FEDERAL AGENCY (3)	TOTAL	EPA REGION 6					EPA REGION 7				EPA REGION 8						EPA REGION 9					EPA REGION 10			
		AR*	LA*	NM*	OK	TX*	IA*	KS*	MO	NE*	CO*	MT	ND*	SD	UT*	WY	AS	AZ*	CA*	GU	HI	NV*	AK	ID*	OR*	WA*
Army Corps of Engineers	14	1	-	-	2	1	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
CIA (4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Agriculture	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Commerce (5)	23	-	-	-	-	2	-	-	-	-	2	-	-	-	-	-	-	-	1	-	-	-	1	-	-	2
Dept of Defense																										
DERP (Active)																										
Bases (6)	103	2	2	3	1	9	1	-	5	-	5	-	-	-	2	-	-	1	16	-	1	2	1	-	2	3
Power Production	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1	-	-	-
Propulsion (7)	174	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25	-	25	-	-	-	-	49
Research Labs	19	-	-	1	-	3	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Weapons Testing	14	-	-	1	-	-	-	-	-	-	-	-	-	-	1	-	-	1	-	-	-	1	-	-	-	-
Weapons Accidents (8)	29	2	2	3	-	2	-	2	-	-	-	-	1	1	1	-	-	-	2	-	-	-	-	-	-	2
DERP/FUDS (Inactive) (9)	7118	83	83	165	21	289	21	41	103	-	103	-	21	21	83	21	-	41	908	537	62	41	41	-	41	1115
Dept of Energy																										
WMO (Active)																										
Diversified Labs (10)	1573	-	-	2	-	-	1	-	-	-	-	-	-	-	-	-	-	-	2	-	-	-	-	1	-	1560
Materials Production	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weapons Production/Test	776	-	-	1	-	1	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	770	-	-	-	-
Physical Research	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Miscellaneous	7	-	-	1	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
ER (Inactive)																										
ER (Remedial Action)(11)	3920	-	-	323	-	40	40	-	202	-	40	-	-	-	40	-	-	-	202	-	-	40	-	121	40	121
FUSRAP	31	-	-	3	-	-	-	-	4	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	1	-
GJRAP (12)	593	-	-	-	-	-	-	-	-	-	593	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
SFMP (11)	36	-	-	4	-	-	-	-	2	1	-	-	-	-	2	-	-	-	3	-	-	-	-	6	-	2
UMTRAP (13)	5039	-	-	20	-	8	-	-	-	-	4464	-	10	138	169	42	-	14	-	-	-	-	-	1	9	-

Exhibit 2-1 (Continued)

FEDERAL AGENCY (3)	TOTAL	EPA REGION 1						EPA REGION 2				EPA REGION 3						EPA REGION 4								EPA REGION 5					
		CT	ME	MA	NH*	RI*	VT	NJ	NY*	PR	VI	DE	DC	MD*	PA	VA	WV	AL*	FL*	GA*	KY*	MS*	NC*	SC*	TN*	IL*	IN	MI	MN	OH	WI
Dept of Health & Human Service	46	-	-	1	-	-	-	-	2	3	-	-	2	7	1	-	1	1	-	2	-	-	1	-	-	-	-	1	1	2	-
Dept of Interior	88	-	-	1	-	-	-	-	1	1	-	-	-	1	2	3	1	2	1	1	-	1	1	-	-	1	1	1	1	-	1
Dept of Justice	4	-	-	-	-	-	-	-	-	1	-	-	1	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Labor	7	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	1	-	-	-	-	-	-	-	-	-	1	-	-	1	-
Dept of Transportation	15	2	-	2	-	-	-	2	1	-	-	-	-	-	-	3	-	-	1	-	-	1		-	-	-	-	-	-	-	-
Dept of the Treasury	3	-	-	-	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
EPA																															
ACTIVE FACILITIES	28	-	-	-	-	1	-	1	1	-	-	-	-	1	-	-	1	1	1	1	-	1	1	-	-	2	-	1	1	1	-
SUPERFUND (Inactive) (14)	45	-	-	1	-	-	-	6	3	-	-	-	-	-	1	-	-	-	2	-	1	-	-	1	1	4	1	-	-	2	-
Government Services Adm	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NASA	13	-	-	-	-	-	-	-	-	-	-	-	-	1	-	2	-	1	1	-	-	1	-	-	-	-	-	-	-	5	-
Postal Service (15)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Small Business Administration	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TVA (16)	22	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8	-	-	-	-	-	-	13	-	-	-	-	-	-
Veterans Administration	121	2	1	-	1	1	1	2	9	1	-	1	1	3	5	3	4	-	4	3	2	2	4	2	4	5	-	5	1	4	2
TOTALS: STATE	19945	609	23	714	23	2	1	423	558	9	0	1	113	386	320	642	8	101	93	138	109	30	73	130	290	386	108	94	4	432	3
REGION	19071						1372				990						1470								964						1027

Exhibit 2-1 (Continued)

FEDERAL AGENCY (3)	TOTAL	EPA REGION 6					EPA REGION 7				EPA REGION 8						EPA REGION 9						EPA REGION 10			
		AR*	LA*	NM*	OK	TX*	IA*	KS*	MO	NE*	CO*	MT	ND*	SD	UT*	WY	AS	AZ*	CA*	GU	HI	NV*	AK	ID*	OR*	WA*
Dept of Health & Human Service	46	1	3	1	1	1	-	-	2	-	1	2	-	1	-	-	-	3	2	-	-	-	1	-	-	2
Dept of Interior	88	1	-	9	3	1	-	1	1	-	9	1	1	1	6	1	-	9	3	-	-	2	1	4	7	6
Dept of Justice	4	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dept of Labor	7	-	-	-	-	-	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-
Dept of Transportation	15	-	-	-	1	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1
Dept of the Treasury	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
EPA																										
ACTIVE FACILITIES	28	-	-	-	1	2	-	1	-	-	2	-	-	-	-	-	-	-	1	-	-	2	-	-	2	2
SUPERFUND (Inactive) (14)	45	-	-	2	1	-	-	-	4	-	4	-	-	-	2	-	-	-	3	-	-	-	-	1	1	4
Government Services Adm	111	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NASA	13	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-
Postal Service (15)	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Small Business Administration	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TVA (16)	22	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-
Veterans Administration	121	-	3	1	2	6	2	3	3	3	1	1	1	3	1	-	-	-	10	-	-	2	-	1	2	3
TOTALS: STATE	19945	90	93	538	32	366	65	48	322	5	5226	4	34	166	306	65	0	69	1181	537	88	860	46	134	104	2869
REGION	19071					1119				440						5801						2735				3153

Exhibit 2-1 (Continued)

NOTES:

(1) Dashes signify either that no State-specific data were available, that no rational basis existed for placing sites within specific States, or that no site is located within the State.

(2) In instances where information was not available on location, the sites were included in the "Total" column. Consequently the two numbers shown at the bottom of the "Total" column will not match until all State data can be obtained.

(3) Acronyms:
CIA - Central Intelligence Agency
DERP - Defense Environmental Restoration Program
DERP/FUDS - Formerly Utilized Defense Sites
EPA - Environmental Protection Agency
ER - Environmental Restoration
FUSRAP - Formerly Utilized Sites Remedial Action Program
GJRAP - Grand Junction Remedial Action Program
NASA - National Aeronautics and Space Administration
SFMP - Surplus Facilities Management Program
TVA - Tennessee Valley Authority
UMTRAP - Uranium Mill Tailings Remedial Action Program
WMO - Waste Management Operations

(4) The number of sites could not be determined from readily available information.

(5) Study underway currently to inventory potentially contaminated sites. Results are expected by late 1990.

(6) The total does not include 34 sites used for stockpiling strategic materials under the management of the Government Services Administration.

(7) D&D assumed to be equally distributed amongst the 7 naval shipyards identified in Exhibit 2-2.

(8) Two of the sites listed are in coastal waters and not in the States themselves. Twenty-nine of the 50 suspected cases have been documented.

Exhibit 2-1 (Continued)

NOTES:

(9) Not all sites are expected to contain radioactive contamination; however, until more is known, all sites are included.

(10) The total of 1573 consists of 13 facilities plus 1 facility within which approximately 1560 discrete, physically separated parcels of land have been identified. Each of the other 13 facilities is expected to contain from 10 to 1500 physically separated land parcels within its boundaries. To avoid over counting and speculation, however, each of the 13 facilities was counted as a single site since details on the number of land parcels were not available.

(11) The ER program includes 220 sites of the former Defense Decontamination and Decommissioning Program plus 30 sites of the former Surplus Facilities Management Program (SFMP). The latter is not included in the total of 3920 sites but is listed separately under SFMP.

(12) Includes 593 sites. Approximately 4450 Grand Junction "vicinity properties" are managed under the UMTRA Program.

(13) Includes 24 sites and approximately 5014 "vicinity properties."

(14) Includes 6 former DoD sites but excludes all UMTRA Program sites.

(15) Although this site is contaminated with mill tailings, it is an active site and therefore not included in the UMTRA Program.

(16) Includes 9 nuclear power plants not counted in the totals of Exhibit 2-7.

2.1.3 Department of Commerce (DoC)[7,40]

The DoC, through the U.S. Maritime Administration, controls the Nuclear Ship Savannah which has undergone D&D and is now stationed at Charleston, South Carolina. The DoC also controls, through the National Bureau of Standards (NBS), the Center for Radiation Research at the Bureau. This Gaithersburg, Maryland site includes a reactor and several accelerators. The total number of potentially contaminated sites controlled by DoC, including various laboratories and food inspection sites, is 23.

Currently, the DoC is undertaking a study to more accurately inventory sites that may be radioactively contaminated. The results of this effort are expected in the October - November time frame.[27]

Residual radioactivity is expected to consist primarily of fission and activation products at the reactor and accelerator sites.

2.1.4 Department of Defense (DoD)[7]

The U.S. Department of Defense through its Departments of Army (including the Army National Guard), Navy (including the Marine Corps), and Air Force (including the Air National Guard) controls a large number of sites both in and outside the conterminous United States. Additional military sites are controlled by the Department of Transportation through the U.S. Coast Guard.

Military facilities range in size from single buildings to large forts and bases which may cover areas as large as a few million acres. These complexes cover a wide range of functions including schools, hospitals, training academies, research and development laboratories, proving grounds, bombing and gunnery practice ranges, storage depots, arsenals, air bases, naval bases, missile launch sites, forts, and manufacturing sites for

weapons and ammunition. Some sites are also used for storage of strategic materials for national stockpiles.

Most of the residual radioactivity at military sites is a result of research and development testing of military munitions, testing and operation of military reactors, or accidents. Sites may be contaminated with plutonium and fission products over large areas, or may have used or stored small quantities of radioactive materials in the form of luminous dial watches, compasses, electron tubes, and lights in electric equipment. Still others have been contaminated with depleted uranium munitions but vary widely in character.

The DoD's Defense Environmental Restoration Program (DERP) has been ongoing since 1983 to restore active (DERP) and formerly utilized defense sites (DERP/FUDS). The Defense Environmental Restoration Program has been codified into law as part of Superfund.

There may be very few sites where radioactive wastes have been buried on site but little information is available regarding deliberate on-site burials.

Refer to Exhibit 2-2 for a list of potentially contaminated DoD sites.

2.1.4.1 Defense Environmental Restoration Program (Active Sites). The Defense Environmental Restoration Program (DERP) is an outgrowth of the overall Installation Restoration Program (IRP). Active sites may have segments that are inactive or which may have been decontaminated. In such cases the overall site is still considered an active site.

- Bases - Bases can be large, sprawling complexes where many and varied activities have been carried out. Some of the military sites such as hospitals, research and development laboratories, and schools will continue in operation for the indefinite future. Others have already been taken out of service and decontaminated and decommissioned but are still part of the active base.

Exhibit 2-2

Department of Defense Sites

Site	Source of Residual Radioactivity
Alaska	
Ft. Greeley	Activation/fission products
Alabama	
Redstone Arsenal	Accelerator
California	
Army Ionizing Radiation	Accelerator
Camp Parks	Sr-90 in hot cell
Camp Roberts	Depleted uranium
China Lake Naval Weapons Center	Depleted uranium
Long Beach Naval Shipyard/Base	Activation/fission products
Mare Island Naval Shipyard	Activation/fission products
Naval Electronics Lab	Accelerator
Naval Post Graduate School	2 Accelerators
Port Hueneme	Activation/fission products
San Diego Naval Base	Activation/fission products
Connecticut	
New London Submarine Base	Activation/fission products
District of Columbia	
Naval Research Lab	13 Accelerators
Naval Research Lab, Reactor	Activation/fission products
Walter Reed Research Reactor	Activation/fission products
Florida	
Eglin Air Force Base	Depleted uranium
Hawaii	
Pearl Harbor Naval Shipyard and Submarine Base	Activation/fission products

Exhibit 2-2 (Continued)

Site	Source of Residual Radioactivity
Indiana	
Crane Naval Weapons Support Ctr	Thorium
Jeffersonville Depot	Zircon sands
Iowa	
Army Ammunitions Plant	Depleted uranium
Maine	
Portsmouth Naval Shipyard	Activation/fission products
Maryland	
Aberdeen Proving Ground	Depleted uranium
Aberdeen Pulsed Reactor	Activation/fission products
Armed Forces Radiobiology Research Institute	Activation/fission products, transuranics
Army Chemical Center	Accelerator
Diamond Ordnance Radiation	Activation/fission products
Edgewood Arsenal	Accelerator
Naval Medical Center	Accelerator
Naval Ordnance Lab	Accelerator
Massachusetts	
Army Quartermaster Depot	2 Accelerators
Michigan	
Detroit Arsenal	Accelerator
Nevada	
Nellis Air Force Base	Depleted uranium, plutonium, fission products
Fallon Naval Air Station	Shoal underground nuclear weapons test

Exhibit 2-2 (Continued)

Site	Source of Residual Radioactivity
New Jersey	
Picatinny Arsenal	Accelerator
New Mexico	
Kirkland Air Force Base	Unknown
White Sands Missile Range (Trinity Site, Fast Burst Reactor)	Activation/fission products
New York	
Watervliet Arsenal	Accelerator
Ohio	
Wright-Patterson Air Force Base	Activation/fission products, accelerator, Am-241
Texas	
Fort Worth (Aerospace Systems Test Reactor, Ground Test Reactor)	Activation/fission products
Medina Base	Depleted uranium
Utah	
Hill Air Force Base	3 Accelerators
Virginia	
Ft. Belvoir	Activation/fission products
Newport News Naval Shipyard	Activation/fission products
Washington	
Puget Sound Naval Shipyard	Activation/fission products
Sandpoint Naval Station	Ra-226

There are 113 military bases/camps/arsenals with expected residual radioactivity. In addition, 34 military reservations have been used to stockpile strategic materials under the management of the Government Services Administration (refer to Section 2.1.13).

- Power Production - Most of the military nuclear reactors were designed to produce electricity and heat and, with the exception of nuclear ship reactors, have been shutdown or dismantled. These power plants were typically used to service remote installations. There were 6 such sites as shown in Exhibit 2-3.

  Residual radioactivity at the non-operating reactors is primarily activation products. Except for the PM-3A site in Antarctica, the waste from which has been sent to the Naval Center at Port Hueneme, California, waste volumes and inventories are not available.

Exhibit 2-3

Department of Defense Power Reactors for Remote Locations

Name	Location
Stationary Medium Power Plant No. 1A	Alaska
Portable Medium Power Plant No. 3A	Antarctica
STURGIS Floating Nuclear Power Plant	Canal Zone
Portable Medium Power Plant No. 2A	Greenland
Stationary Medium Power Plant No. 1	Virginia
Portable Medium Power Plant No. 1	Wyoming

- Propulsion - The U.S. Navy has constructed approximately 150 nuclear submarines and about a dozen surface ships. To support its nuclear powered ships, the Navy has 11 shipyards, 13 tenders, and 2 submarine bases for a total of approximately 174.

  Residual Radioactivity consists primarily of activation and fission products. In addition, low levels of radioactivity (principally Co-60) are also usually present in harbor sediments where ships are serviced. This is true not only for the shipyards listed in Exhibit 2-2, but also for other nuclear ship bases such as those at Guam, Scotland, and possibly others.

- Research Labs - The DoD has operated several small test and research reactors for simulating the effects of nuclear weapons and for other physical and medical research. Most of these have been shut down or dismantled. There are 19 such sites as indicated in Exhibit 2-4.

  Residual contamination at non-operating reactors consists primarily of fission and activation products. Remediation efforts at recently shutdown reactors will contend with spent fuel and fresh fission products.

- Weapons Testing - There are several nuclear weapons test sites where missile, gunnery and bomb testing is performed. Tests can be both surface and underground, on-site and off-site. There are at least two sites where nuclear bombs were detonated, and approximately 11 sites where depleted uranium shells have been fired. In addition, there is one site where nuclear weapons have been assembled and stored, for a total of 14.

  Residual radioactivity from bomb testing is expected to range widely and include fission products as well as plutonium. The Nellis Air Force Base and Nellis Bombing and Gunnery Range encompass about three million acres, portions of

Exhibit 2-4

Department of Defense Test and Research Reactors

Name	Location
U.S. Navy Postgraduate School	California
Naval Research Center	District of Columbia
Walter Reed Research Reactor	District of Columbia
Radiation Effects Reactor	Georgia
Pool Type Reactor	Georgia
Army Materials Research Center	Massachusetts
Aberdeen Pulsed Reactor	Maryland
Armed Forces Radiobiology Research Institute	Maryland
Diamond Ordnance Facility	Maryland
U.S. Naval Hospital	Maryland
Fast Burst Reactor	New Mexico
Nuclear Engineering Test Reactor	Ohio
Aerospace Systems Test Reactor	Texas
Ground Test Reactor	Texas
Reactivity Test Assembly	Texas

which are contaminated by fallout from atmospheric nuclear weapons and weapons safety tests.

Residual radioactivity can also be present in the form of shell fragments (from projectiles that incorporated depleted uranium), storage and waste areas, and contaminated soils.

- Accidents of Weapons Carriers - Very little information has been released by the DoE or the DoD on residual radioactivity associated with accidents involving weapons carriers in the United States. A few accidents are known to have had residual radioactivity associated with them, some on sites already contaminated with radioactivity, but essentially no unclassified information has been reported. Some accidents may also have involved other radioactive but non-fissionable radionuclides (e.g., tritium). Estimates of the total number of weapons accidents range up to more than 50. Exhibit 2-5 summarizes the information available for 29 documented cases.

  The extent of residual radioactivity at nuclear weapons accident sites is unknown. Possible contaminants would be plutonium, enriched uranium and tritium.

2.1.4.2 Defense Environmental Restoration Program/Formerly Utilized Defense Sites (Inactive Sites). The DERP Formerly Utilized Defense Sites (FUDS) activity is managed by the U.S. Army Corps of Engineers. Included are efforts related to hazardous and toxic/radiologic wastes, ordnance and explosive waste and building demolition on lands formerly owned or used by any DoD component for which DoD is responsible.

Exhibit 2-5

Nuclear Weapons Carrier Accidents

Date	Location	Weapons System
2/13/50	Pacific Ocean, off Puget Sound, WA	B-36
4/11/50	Manzano Base, New Mexico	B-29
7/13/50	Lebanon, Ohio	B-50
8/05/50	Travis AFB, California	B-29
1/09/56	Kirkland AFB, New Mexico	B-36
5/22/57	Kirkland AFB, New Mexico	B-36
10/11/57	Homestead AFB, Florida	B-47
12/12/57	Fairchild AFB, Washington	B-52
2/05/58	Savannah, Georgia, 5 miles off coast	B-47
3/11/58	Florence, South Carolina	B-47
5/22/58	Leonardo, New Jersey	Nike Missile
11/04/58	Dyess AFB, Texas	B-47
11/26/58	Chennault AFB, Louisiana	B-47
7/06/59	Barksdale AFB, Louisiana	C-124
10/15/59	Glen Bean, Kentucky	B-52 & KC-135
6/07/60	McGuire AFB, New Jersey	BOMARC Missile
1/19/61	Monticello, Utah	B-52
1/24/61	Goldsboro, North Carolina	B-52
3/14/61	Yuba City, California	B-52
11/13/63	Medina Base, Texas	Storage Site
1/13/64	Cumberland, Maryland	B-52
12/05/64	Ellsworth AFB, South Dakota	Minuteman Missile
12/08/64	Grissom AFB, Indiana	B-58
8/09/65	Searcy, Arkansas	Titan Missile
10/12/65	Wright-Patterson AFB, Ohio	C-124
8/24/78	Rock, Kansas	Titan Missile
4/80	Wichita, Kansas	Titan Missile
9/16/80	Grand Forks AFB, North Dakota	B-52
9/19/80	Damascus, Arkansas	Titan II ICBM

A total of 7118 formerly used properties with potential for inclusion in the program have been identified. Preliminary assessments at 1934 sites have been completed. Not all are expected to have radioactive contamination; however, until more complete information is available, all 7118 sites are included in Exhibit 2-1.[HR-25]

2.1.5 Department of Energy (DoE)

The U.S. DoE has responsibility for most of the government controlled contaminated sites and materials in this country. There are DoE sites present in almost every state. Sites range from small, slightly contaminated laboratory type rooms to large, complex, highly contaminated processing plants, as well as surrounding contaminated lands. Besides sites that are government owned, DoE has responsibility for some sites that were formerly used in government operations or for the benefit of the government.

These DoE sites include the national laboratories, those undergoing remedial action, and sites associated with specific research and development programs. These are further classified as Waste Management Operations (active sites) or Environmental Restoration (inactive and surplus sites) in accordance with the terminology used in DoE's Five-Year Plan.[20] Refer to Exhibit 2-6 for the names and locations of DoE sites.

2.1.5.1 Waste Management Operations (Active Sites).[7,20,33] The Waste Management Operations (WMO) portion of DoE's Five-Year Plan is dedicated to waste management at all active sites. As the Five-Year Plan gets further into implementation, it is expected that details will emerge on identification of sites. For now, the following sites have been identified.

- Diversified Laboratories - These are major complexes that have diversified programs. There are nine major national laboratories and 5 more focused labs for a total of 14 complexes in this category. Among these 14 is the National Laboratory at Hanford, Washington. Hanford is reported to have approximately 1560 potentially contaminated sites within its borders.[33]

Exhibit 2-6

Department of Energy Sites

ACTIVE Sites

Diversified Laboratories

- Major National Laboratories

Argonne National Lab	Chicago, Illinois
Brookhaven National Lab	Upton, New York
The National Lab at Hanford/PNL	Richland, Washington
Idaho National Engineering Lab	Idaho Falls, Idaho
Lawrence Livermore National Lab	Livermore, California
Los Alamos National Lab	Los Alamos, New Mexico
Oak Ridge National Lab	Oak Ridge, Tennessee
Sandia National Lab	Albuquerque, New Mexico
Savannah River Lab	Aiken, South Carolina

- Other Diversified Laboratories

Ames	Ames, Iowa
Bettis Atomic Power Lab	West Mifflin, Pennsylvania
Knolls Atomic Power Lab	Nishayuna, New York
Lawrence Berkeley Lab	Berkeley, California
Mound	Miamisburg, Ohio

Nuclear Materials Production Sites

Ashtabula - Materials	Ohio
Fernald - Materials	Ohio
Oak Ridge (K-25) - Enrichment	Tennessee
Paducah - Enrichment	Kentucky
Portsmouth - Enrichment	Ohio

Weapons, Production and Testing

Alamogordo - Nuclear Testing	New Mexico
Kansas City - Non-nuclear material	Missouri
Nevada Test Site - Nuclear testing	Nevada
Oak Ridge (Y-12) - Plutonium materials	Tennessee
Other Test Sites - Nuclear Testing	Mississippi, New Mexico
Pantex - Weapons Assembly	Texas
Pinellas - Neutron generators	Florida
Rocky Flats - Plutonium materials	Colorado

Rocky Flats - Plutonium materials	Colorado

Exhibit 2-6 (Continued)

ACTIVE Sites (Continued)

Physical Research

Bates Linear Accelerator - Physics	Massachusetts
Fermi National Accelerator - Physics	Illinois
Notre Dame - Physical chemistry	Indiana
Stanford Linear Accelerator - Physics	California

Miscellaneous Sites

New Brunswick - Safeguards	Illinois
Princeton Plasma Physics - Fusion	New Jersey
Waste Isolation Pilot Project	New Mexico

INACTIVE Sites

ER (Remedial Action & Defense D&D)

Grand Junction Site	Colorado
Idaho National Engineering Lab (Portion)	Idaho
New Brunswick Lab	New Jersey
Knolls Atomic Power Lab (Portion)	New York
Mound (Portion)	Ohio
Oak Ridge National Lab (Portion)	Tennessee

FUSRAP

Gilman Hall, U of Cal, Berkeley	California
Seymor Specialty Wire	Connecticut
Palos Park Forest Preserve	Illinois
Labs at U of Chicago	Illinois
National Guard Armory	Illinois
W. R. Grace, Curtis Bay	Maryland
Shpack Landfill	Massachusetts
Ventron, Beverly	Massachusetts
St. Louis Airport & vicinity	Missouri
Latty Avenue Properties	Missouri
St. Louis Downtown Site	Missouri
General Motors, Adrian	Michigan

Exhibit 2-6 (Continued)

Exhibit 2-6 (Continued)

INACTIVE Sites (Continued)

E. I. du Pont, Deepwater	New Jersey
Kellex Research, Jersey City	New Jersey
Middlesex Muncipal Landfill	New Jersey
Middlesex Sampling Plant	New Jersey
W. R. Grace, Sheffield Brook	New Jersey
Stepan Chemical	New Jersey
Acid/Pueblo/Los Alamos Canyons	New Mexico
Bayo Canyon, Los Alamos	New Mexico
Chupadera Mesa, White Sands Missile	New Mexico
Linde Air Products	New York
Colonie Interim Storage Site	New York
Niagara Falls Storage Site	New York
Ashland Oil No. 1	New York
Ashland Oil No. 2	New York
Seaway Industrial Park	New York
Albany Metallurgical Research Center	Oregon
Aliquippa Forge	Pennsylvania
Elza Gate	Tennessee

GJRAP

593 Properties, Grand Junction	Colorado

SFMP

Santa Susana Field Lab	California
Idaho National Engineering Lab	Idaho
Argonne National Lab	Illinois
Weldon Springs Site	Missouri
Los Alamos National Lab	New Mexico
Lewiston (Niagara Falls Storage Site)	New York
Mound Plant Advanced Systems	Ohio
Battelle Columbus Lab	Ohio
Shippingport Station	Pennsylvania
Savannah River Site	South Carolina
Oak Ridge National Lab	Tennessee
Monticello Site	Utah
Hanford Site	Washington

Exhibit 2-6 (Continued)

INACTIVE Sites (Continued)

UMTRAP

Monument Valley	Arizona
Tuba City	Arizona
Durango	Colorado
Grand Junction	Colorado
Gunnison	Colorado
Maybell	Colorado
Naturita	Colorado
New Rifle	Colorado
Old Rifle	Colorado
Slick Rock - NC Site	Colorado
Slick Rock - UC Site	Colorado
Lowman	Idaho
Ambrosia Lake	New Mexico
Shiprock	New Mexico
Belfield	North Dakota
Bowman	North Dakota
Lakeview	Oregon
Canonsburg	Pennsylvania
Falls City	Texas
Green River	Utah
Mexican Hat	Utah
Salt Lake City	Utah
Converse County	Wyoming
Riverton	Wyoming

- Nuclear Materials Production - These sites are devoted to manufacturing nuclear fuels and targets. There are 5 sites in this category.
- Weapons Production and Testing Sites - These sites are concerned with nuclear weapons from the design and testing phases to the full production phase. Seven complexes are included in this category. One of these, the Nevada Test Site, reports approximately 770 individual test sites.
- Physical Research - Four sites devoted to basic research at universities have been identified.
- Miscellaneous Sites - This category includes small laboratories for fusion and nuclear safeguards work, the Waste Isolation Pilot Plant (WIPP) intended for the permanent geologic disposal of defense transuranic waste, the West Valley Project, and a DoE Area Office. Seven sites have been identified for this category.

2.1.5.2 Environmental Restoration (Inactive Sites).[20,30,33] DoE has several ongoing environmental restoration (ER) programs that directly involve the remediation and/or decontamination and decommissioning of DoE-controlled sites contaminated by activities of DoE and its predecessors, some of which have recently been combined. One example is the Surplus Facilities Management Program (SFMP), now included under the Decontamination and Decommissioning Division of ER. These programs are described briefly below.

- ER (Remedial Action) - The Remedial Action portion of the ER segment of the DoE Five-Year Plan is dedicated to the management of inactive DoE sites, including those that have the potential for releases to the environment (called Remedial Actions) and certain surplus facilities (called Defense Decontamination and Decommissioning). There are approximately 220 of the latter at 7 locations

throughout the United States, and about 3700 of the former for a total of 3920. Of the 3700 remedial action sites, not all may be radioactively contaminated but are included in Exhibit 2-1 until more information becomes available. Additionally, approximately 30 Surplus Facility Management Program sites have been absorbed into the ER segment but are discussed and tabulated separately as discussed below.

- Formerly Utilized Sites Remedial Action Program (FUSRAP) - FUSRAP is primarily concerned with waste clean-up of sites that were formerly used to support the nuclear activities of DoE's predecessor agencies: the Manhattan Engineering District established for the Manhattan Project, and the Atomic Energy Commission. There are 31 sites in this category.

  Residual radioactivity at FUSRAP sites can include floor tiles, soils, building rubble, road materials, piping and tanks. The primary contaminants at these sites are uranium, thorium and radium. These are usually present at low activity levels, though they vary from site to site.

- Grand Junction Remedial Action Project (GJRAP) - Underway since 1973, the GJRAP was a precursor to the Uranium Mill Tailings Remedial Action Program and was designed to oversee the rehabilitation of structures that utilized uranium mill tailings in some phase of their construction. There are 593 decontaminated sites in this category.

  In addition to the 593 sites, there are approximately 4450 vicinity properties at Grand Junction that are managed under the UMTRA Program discussed below. Most of the residual radioactivity at the GJRAP sites consists of uranium tailings and tailings mixed with soil. The uranium and thorium in the soil compose the primary radionuclides.

Currently, there are no plans for other than on-site remediation of older sites that may not comply with today's standards.[HR-16]

2.3 STATE SITES

Sites within this category consist primarily of consumer product and commodity manufacturers, mines, oil and gas production sites, power plants, research sites and water treatment plants not under the authority of the NRC/Agreement States. In some cases, the States issue permits and licenses to operators. In other cases, licenses have not been issued either because the residual radioactivity levels are sufficiently low to not be a public or worker health problem, or the newness of the issues involved (e.g., NORM).

Refer to Exhibit 2-8 for a listing of the more than 6500 sites identified by type and location. Note that 1.5 million oil and gas production sites and over 52,000 coal-fired boiler plants are not counted in the overall totals. This was done to preclude obscuring the results obtained for the rest of the category.

2.3.1 Manufacturing Plants

- Radiation Devices and Consumer Products - This category includes manufactured products that incorporate byproduct materials produced by the NRC/Agreement State licensees (refer to Section 2.2.2) into the finished goods, such as self-luminous devices, gas and aerosol detectors, static eliminators, measuring and controlling devices, etc. The manufacturers are licensed by the State to manufacture the product, and granted a general license by the NRC to distribute the product. The manufacturer itself issues a "general license" for possession and disposal to the consumer.[HR-14] Because of the difficulty involved with differentiating these licenses within the overall licensee data base, the total is included with the NRC/Agreement State total in Section 2.2.2.[36]

Exhibit 2-8

Number of State-Administered Sites with Potential Residual Radioactivity, by Site Type and Location (1,2)**

SITE TYPE	TOTAL	EPA REGION 1						EPA REGION 2				EPA REGION 3						EPA REGION 4								EPA REGION 5					
		CT	ME	MA	NH*	RI*	VT	NJ	NY*	PR	VI	DE	DC	MD*	PA	VA	WV	AL*	FL*	GA*	KY*	MS*	NC*	SC*	TN*	IL*	IN	MI	MN	OH	WI
MANUFACTURING																															
Rad Devices/ Products (4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphate Production Plants	118	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22	12	-	-	1	6	-	3	8	-	-	-	-	-
MINING																															
Mineral Processing	108	-	-	-	-	-	-	-	2	-	-	2	-	2	1	-	-	1	17	1	2	2	2	1	4	2	1	1	-	5	-
Uranium (Active & Inactive)	3737	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	26	-	-	-	2	-	-	-	-	-	1	-	-
OIL & GAS PRODUCTION (5)	1.5 Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
POWER PLANTS																															
Coal (5)	52400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrothermal (3)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RESEARCH	1850	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER TREATMENT (6)	700	-	-	-	-	-	-	50	-	-	-	-	-	-	-	-	-	-	-	50	-	-	50	50	-	71	-	-	71	-	71
OTHER (7)	1	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS: STATE (3)	6514	0	0	0	0	0	0	51	3	0	0	2	0	2	1	0	0	23	55	51	2	3	60	51	7	81	1	1	72	5	71
REGION (3)	4472						0				54						5								252						231
							-				--						-								---						---

* Agreement State

** Numbers in parentheses refer to notes on page 50.

Exhibit 2-8 (Continued)

SITE TYPE	TOTAL	EPA REGION 6					EPA REGION 7				EPA REGION 8						EPA REGION 9						EPA REGION 10			
		AR*	LA*	NM*	OK	TX*	IA*	KS*	MO	NE*	CO*	MT	ND*	SD	UT*	WY	AS	AZ*	CA*	GU	HI	NV*	AK	ID*	OR*	WA*
MANUFACTURING																										
Rad Devices/ Products (4)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphate Production Plants	118	1	7	-	-	7	3	-	3	-	-	1	-	-	1	1	-	-	-	-	-	-	-	8	-	-
MINING																										
Mineral Processing	108	2	1	5	1	7	-	-	1	-	4	2	-	-	2	2	-	5	5	-	-	1	1	10	4	9
Uranium (Active & Inactive)	3737	-	-	238	3	50	-	-	-	-	1327	19	13	148	1144	340	-	327	25	-	-	24	4	11	3	18
OIL & GAS PRODUCTION (5)	1.5 Million	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
POWER PLANTS																										
Coal (5)	52400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hydrothermal (3)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
RESEARCH	1850	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WATER TREATMENT (6)	700	-	-	-	-	-	71	-	71	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OTHER (7)	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TOTALS: STATE (3)	6514	3	8	243	4	64	74	0	75	0	1331	22	13	148	1147	343	0	332	30	0	0	25	5	29	7	27
REGION (3)	4472					322				149						3004						387				68

Exhibit 2-8 (Continued)

NOTES:

(1) Dashes signify either that no State-specific data were available, that no rational basis existed for placing sites within specific States, or that no site is located within the State.

(2) In instances where information was not available on location, the sites were included in the "Total" column. Consequently the two numbers shown at the bottom of the "Total" column will not match until all State data can be obtained.

(3) The number of sites could not be determined from readily available sources of information.

(4) Sites included in Exhibit 1-7 under Manufacturing/Radiation Devices & Consumer Products. Available data would not allow segregation.

(5) Not included in totals to avoid obscuring results.

(6) Values shown represent the number of effected water treatment systems averaged over the number of states in that region.

(7) Sites once licensed by the Atomic Energy Commission (AEC, predecessor to the Nuclear Regulatory Commission) or Agreement States that have since reverted back to the States. The site listed represents the low-level radioactive waste disposal portion of West Valley now under the management of New York State.

Residual radioactivity would be typical of that of sealed source manufacturers and would exist as a result of leaky sources.

- Phosphate Production Plants[18,HR-10] - The phosphate cycle consists of mining, processing and product formation. Mined phosphate rock (ore) is processed by washing, flotation and drying. It is then transformed into elemental phosphorous or into phosphoric acid for fertilizers, detergents, and so on. There are approximately 24 mines and 31 processing and manufacturing sites in the United States.

  The process creates a slurry which subsequently is discharged onto waste piles (phosphogypsum stacks). Since the ore contains naturally occurring radioactive material (NORM), this process tends to concentrate this material and create elevated levels of contaminants. There are approximately 63 phosphogypsum stacks, making a total of 118 sites in this category.

  In addition, one of the products of this process, phosphate fertilizer, contains elevated levels of radionuclides. The fertilizers produced are spread over large tracts of agricultural land to replenish natural nutrients depleted from soils due to farming and erosion. This activity introduces slightly elevated concentrations of Ra-226 into soils nationwide. However, the presence of radionuclides in soils at individual farms is still low since the rate at which fertilizer is applied is governed by the type of crop and pre-existing soil conditions. Prolonged use could unduly expose people who live or work on the land at some point in the future. For now, farms using phosphate fertilizers are not included in this category.

2.3.2 Mining

- Minerals Processing - As with uranium mining, the processing of ores rich in aluminum, copper, nickel, zinc and other minerals results in the concentration of

naturally occurring radioactive materials (NORM) as a result of the techniques used.[HR-26]

There are approximately 108 sites where concentrated NORM exists as a result of the mineral extraction process.

- Uranium - These facilities extract uranium ore from above and below ground mines. Mining wastes are generally segregated into tailing waste piles (see Sections 2.1.5.2 and 2.2.6) and subore piles, the latter being natural materials extracted from the earth enroute to the ground depth of interest. Subore piles typically contain uranium (and uranium daughter products) in lower concentrations than is economically feasible to process. Most waste stays on-site and the amount generated depends upon the mining method used, the richness of the ore, and the economic conditions at the time.

  Only 4 of the approximately 3737 uranium mines in the United States are active currently.[HR-24]

2.3.3 Oil and Gas Production[18,HR-26]

There are over 1.5 million oil and gas wells in the United States. Water associated with the extraction of oil and gas from the earth contains elevated levels of naturally occurring radioactive material (NORM). Over time, the insides of extraction pipes become coated with a concrete-like substance called "scale." Pipe scale can be very high in Ra-226 and Ra-228.

Residual radioactivity takes the form of discarded pipes either left on-site to rust, sent to scrap yards where they may be reused, or recycled on-site where scale is removed and dumped or stored on-site in 55 gallon drums.

2.3.4 Power Plants[18,HR-26]

- Fossil Power - Coal-fired units are used in the production of electrical power. The use of coal fuel results in the accumulation of naturally occurring radioactive material (NORM) in the fly ash and bottom ash which are collected and impounded on or off site. There are approximately 1300 utility coal-fired boilers and 51,100 industrial coal-fired boilers throughout the nation, for a total of approximately 52,400.

  The concern with NORM is the presence of long-lived radionuclides in potentially recyclable ash. This can be used by a variety of industries (e.g., concrete, wallboard) which may result in elevated radiation levels in structures utilizing such materials.

- Hydrothermal - The pipe scale issues discussed in Section 2.3.3, Oil and Gas Production, apply to the category of hydrothermal power plants as well. The number and distribution of these plants could not be determined from readily available references.

2.3.5 Research[9,18]

It is estimated that there are perhaps 1200 - 2000 atomic particle accelerators operating within the United States. Accelerators are found in every State with broad application in physics, chemistry, radiobiology, medical radiation therapy, radiation processing and sterilization, industrial radiography and ion implantation for integrated electron circuit fabrication.

Of the large number of accelerators, approximately 150 have relatively high beam energy levels (>10 MeV) and are either licensed by the NRC/Agreement States or belong to the military. The larger machines create a category of waste called NARM (naturally

occurring and accelerator produced radioactive materials). Those that remain are the relatively small accelerators generally exempt from NRC/Agreement State regulation. There are about 1850 accelerators in this category.

At the lower energy levels, there is insufficient energy to create significant activation products. It is expected that residual radioactivity can be readily managed by natural decay.

2.3.6 Water Treatment[HR-26]

There are approximately 50 - 60,000 water supply companies in the United States. Approximately 3300 such companies obtain their water from underground sources, about 700 of which have elevated levels of radionuclides. The process of treating these waters creates various waste forms: a sludge, ion-exchange resins, granulated activated carbon and reject water from filter backwash. If the groundwater originally had elevated levels of radioactivity, the resulting wastes would also be radioactive.

Residual radioactivity takes the form of dissolved and suspended naturally occurring radioactive materials (NORM) that concentrate in the sludge. The sludge is typically dumped locally or sold to firms that produce fertilizer.

2.3.7 Other

There are certain facilities once licensed by the Atomic Energy Commission (AEC, the predecessor to NRC) or Agreement States that have since been taken over by States. An example is the West Valley complex in New York where the State is responsible for the LLW disposal site located there. Only one such site has been identified from the available literature.

2.4 FUTURE PROJECTIONS[11,HR-15]

With respect to Federal sites, DoE and DoD represent over 98 percent of potentially contaminated sites. The initial phases of DoE's Waste Management Program are expected (1) to produce a complete assessment of the numbers of DoE sites potentially contaminated with radioactive materials, and (2) to serve as a model for other Federal agencies to update their inventory of sites. It is unclear at this time whether all relevant information will be obtained from the DoD.

With respect to NRC/Agreement State licensees, no significant increase in licensed sites is expected for the foreseeable future; however, new sites are expected to be identified as a result of proposed NRC regulations that would require its licensees to identify the extent and nature of residual radioactivity at licensed sites.

Additionally, there may be several emerging NORM issues within the purview of the States. Since NORM is a relatively new concern, it is possible that past practices may have allowed contaminated radioactive material to have been recycled. If so, "contaminated scrap metal" could end up contaminating facilities such as steel mills that were used in the recycling process, as well as products produced from that steel.

3. Nature and Extent of Residual Radioactivity and Information Gaps

Exhibit 3-1 lists the site categories of interest and the material that has been the cause of residual radioactivity. This exhibit provides a very general overview of the types of residual radioactivity issues associated with each category of site. However, a much more detailed characterization of the nature and extent of residual radioactivity is required to support the development of residual radioactivity guidelines and criteria. For example, information is required on physical quantities and characteristics, radioactive and chemical characteristics, and waste disposal characteristics. A great deal of detailed information is contained in the references cited in this report. In addition, DOE contractor reports are compiling detailed information in support of the various remedial programs.

Notwithstanding the large amount of information that is available, information gaps exist. With the relatively recent increase in Federal environmental restoration activity, it is expected that in the near term virtually complete information will be available on site identification in the Federal sector. Since the DoD and the DoE manage the greatest number of contaminated sites, the results of ongoing programs are expected to capture the majority of missing information.

Access to the DoE data is primarily through the Integrated Data Base.[30] It is not clear at this point if access to the DoD data base will be possible. Between the two departments, over 98% of the contaminated site data would be in hand when complete. However, site characterization activity for most sites is still underway and probably 5-10 years from completion. Additionally, the EPA is completing a comprehensive data base on contaminated sites that should be available in calendar year 1991.

Information available is fairly complete with respect to NRC/Agreement State site identification. However, there are gaps in identifying the number of sites administered by each State. In addition, there is limited information characterizing the sites. For

Exhibit 3-1

Sites with Potential Residual Radioactivity, by Site Type and Contaminating Waste Type

SITE TYPE	WASTE TYPES: SPENT FUEL	HIGH LEVEL	TRANS-URANIC	LOW LEVEL: GREATER THAN CLASS C	LOW LEVEL: CLASS A,B,C	MIXED	NARM: URANIUM MILL TAILINGS	NARM: ACCELERATOR PRODUCED	NARM: NORM
FEDERAL SITES									
Army Corps of Engineers	-	-	-	-	X	-	-	-	-
Dept of Agriculture	-	-	-	-	X	-	-	-	-
Dept of Commerce	-	-	-	X	X	-	-	X	-
Dept of Defense									
DERP (ACTIVE)									
BASES	X	-	-	X	X	X	-	-	-
POWER PRODUCTION	X	-	X	X	X	X	-	-	-
PROPULSION	X	-	X	X	X	X	-	-	-
RESEARCH LABS	X	X	X	X	X	X	-	X	X
WEAPONS TESTING	-	-	X	X	X	-	-	-	-
WEAPON CARRIER ACCIDENTS	-	-	X	-	X	-	-	-	-
DERP/FUD (INACTIVE)	-	-	-	-	X	X	-	-	-
Dept of Energy									
WMO (ACTIVE)									
DIVERSIFIED LABS	X	X	X	X	X	X	-	X	-
MATERIALS PRODUCTION	-	-	-	X	X	X	-	-	-
WEAPONS PRODUCTION/TEST	-	-	X	X	X	-	-	-	-
PHYSICAL RESEARCH LABS	-	-	-	X	X	X	-	X	-
MISCELLANEOUS	X	X	X	-	X	X	X	-	X
ER (INACTIVE)									
ER (REMEDIAL ACTION)	-	-	X	-	X	-	-	-	-
FUSRAP	-	-	X	-	X	-	-	-	X
GJRAP	-	-	-	-	-	-	X	-	X
SFMP	X	X	X	X	X	X	X	X	X
UMTRAP	-	-	-	-	-	-	X	-	X
Dept of Health & Human Services	-	-	-	-	X	-	-	X	-
Dept of Interior	X	-	-	X	X	-	X	-	X
Dept of Justice	-	-	-	-	X	-	-	-	-
Dept of Labor	-	-	-	-	X	-	-	-	-
Dept of Transportation	-	-	-	-	X	-	-	-	-
Dept of the Treasury	-	-	-	-	X	-	-	-	-
EPA									
ACTIVE FACILITIES	-	-	-	-	X	-	X	-	-
SUPERFUND (INACTIVE)	-	-	X	-	X	X	X	-	X
General Services Adm	-	-	-	-	-	-	-	-	X
NASA	-	-	-	X	X	-	-	X	-
Postal Service	-	-	-	-	X	-	-	-	-
TVA	X	-	-	X	X	-	X	-	X
Veterans Adm	X	-	-	X	X	-	-	X	-

Exhibit 3-1 (Continued)

SITE TYPE	SPENT FUEL	HIGH LEVEL	TRANS-URANIC	LOW LEVEL: GREATER THAN CLASS C	LOW LEVEL: CLASS A,B,C	MIXED	URANIUM MILL TAILINGS	NARM: ACCELERATOR PRODUCED	NARM: NORM
	WASTE TYPES								
NRC/AGREEMENT STATES									
MEDICAL SITES									
Hospitals & Medical Centers	-	-	-	-	X	-	-	X	-
Nuclear Pharmacies	-	-	-	-	X	-	-	-	-
MANUFACTURING PLANTS									
RAD DEVICES & CONSUMER PRODUCTS	-	-	-	-	X	-	-	-	-
RADIO-PHARMACEUTICAL/MAT	-	-	X	X	X	-	-	-	-
RADIOACTIVE SEALED SOURCE	-	-	X	X	X	-	-	-	-
NON-DEFENSE RESEARCH LABS	-	-	-	-	X	-	-	X	X
NUCLEAR POWER REACTORS	X	-	X	X	X	X	-	-	-
NUCLEAR RESEARCH & TEST REACTORS	X	-	X	X	X	X	-	-	-
URANIUM FUEL CYCLE SITES									
MILLING	-	-	-	-	X	-	X	-	X
CONVERSION	-	-	-	-	X	X	-	-	-
ENRICHMENT	-	-	X	X	X	-	-	-	-
FUEL FABRICATION	-	-	X	X	X	-	-	-	-
FUEL REPROCESSING	X	X	X	X	X	X	-	-	-
WASTE MANAGEMENT									
PROCESSING/TREATMENT	-	-	-	-	X	X	-	-	-
SPENT FUEL STORAGE	X	-	X	X	X	-	-	-	-
DISPOSAL	X	X	X	-	X	X	-	-	-
STATES									
MANUFACTURING									
RAD DEVICES & CONSUMER PRODUCTS	-	-	-	-	X	-	-	-	-
PHOSPHATE PRODUCTION PLANTS	-	-	-	-	-	-	-	-	X
MINING									
MINERAL PROCESSING	-	-	-	-	-	-	-	-	X
URANIUM (ACTIVE & INACTIVE)	-	-	-	-	-	X	-	-	X
OIL & GAS PRODUCTION	-	-	-	-	-	-	-	-	X
POWER PLANTS									
COAL	-	-	-	-	-	-	-	-	X
HYDROTHERMAL	-	-	-	-	-	-	-	-	X
RESEARCH	-	-	-	-	-	-	-	X	-
WATER TREATMENT	-	-	-	-	-	-	-	-	X
OTHER	-	-	-	-	X	-	-	-	-

example, it would be helpful if the various sites could be further subdivided into decontamination units, such as, labs, hoods, bench top areas, contaminated floor space, linear feet of piping and ductwork, tons of contaminated and/or activated concrete and metal, etc. Such information is available to varying degrees in the available literature but will likely need to be supplemented with detailed evaluations of selected "reference" sites. A proposed NRC rulemaking is intended to fill this information gap.

Some of the newest residual radioactivity concerns are administered by the States; specifically NARM waste. Consequently, as these issues are recognized throughout industry, new information is being developed. Details on the extent and nature of residual radioactivity of State-administered sites does not appear to exist, and the prospects for compiling such data appear remote.[HR-14]

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21.	5/90	Federal Liabilities Under Hazardous Waste Laws - U.S. Congressional Budget Office

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HR-2 Mr. David Bernhardt, Rogers and Associates Engineering Corp., P.O. Box 330, Salt Lake City UT, 84410

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HR-9 Mr. George J. Konzek, Battelle Northwest Laboratory, Richland WA, 99352

HR-10 Mr. Michael Mays, Idaho Dept. of Health and Welfare, Boise, ID, 83720

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HR-12 Mr. Paul Thrash, U.S. Department of Energy, San Francisco Operations Office, Oakland, CA, 94612

HR-13 Ms. Maureen Moriarty, U.S. Nuclear Regulatory Commission, White Flint, Maryland

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HR-18 Mr. Lowell Ralston, S. Cohen & Associates, McLean, Virginia

HR-19 Ms. Mollie Quasebarth, U.S. Congressional Budget Office, Washington, D.C.

HR-20 Mr. David Lechel, Roy F Weston UMPTRA Project Office, Albuquerque, New Mexico

HR-21 Mr. Nick Morgan, U.S. Environmental Protection Agency, Office of Federal Facilities Enforcement, Washington, D.C.

HR-22 Ms. Pat Vacca, U.S. Nuclear Regulatory Commission, White Flint, Maryland

HR-23 Ms. Julie Erickson, U.S. Department of Energy, Richland Operations Office, Environmental Office, Richland, WA

HR-24 Mr. Paul Pierce, S. Cohen & Associates, Albuquerque, New Mexico

HR-25 Dr. Bruce Heitke, U.S. Army Corps of Engineers, Washington, D.C.

HR-26 Mr. J-C Dehmel, S. Cohen & Associates, New York

HR-27 Mr. Edward Wilczynski, U.S. Department of Commerce, Washington, D.C.

HR-28 Mr. Edward Wandelt, U.S. Postal Service, Washington, D.C.

HR-29 Mr. Cecil Brown, North Carolina State Department of Environment, Health and Natural Resources, Raleigh, North Carolina

Appendix

Definitions

- Accelerator - Any device that accelerates charged, sub-atomic particles or nuclei to energies useful for research.
- Activation Products - A radioactive material produced by bombardment with nuclear particles.
- Agreement State - Any state with which the Atomic Energy Commission or the Nuclear Regulatory Commission has entered into an effective agreement under subsection 274b of the Atomic Energy Act. A "Non-Agreement State" means any other state.[22]
- Byproduct Material - Any radioactive material (except special nuclear material) yielded in or made radioactive by the radiation incident to the process of producing or utilizing special nuclear material.[22] Basically this means material made radioactive from interfacing with plutonium or certain isotopes of uranium defined as special nuclear materials. Byproduct material includes mill tailings as defined in the Uranium Mill Tailings Radiation Control Act of 1978.
- Decontamination & Decommissioning - The process of removing radioactive materials, removing the site safely from service, and disposing of the radioactive materials. The level of any residual radioactivity on the site must be low enough to permit unrestricted access to the general public.
- Radiation Devices - A product into which is placed a sealed radioactive source, e.g., a home fire alarm.
- Facility - An installation or landholding encompassing all contiguous land owned by a department or agency of the United States, an NRC/Agreement State licensee, or a private entity.
- Fission Products - Radionuclides produced either directly by nuclear fission (splitting of heavy atoms such as uranium) or the subsequent decay of those radionuclides.
- Greater-Than-Class-C Low-Level Waste (GTCC) - Low level radioactive waste containing radionuclide concentrations that exceed Nuclear Regulatory Commission limits for Class C low-level waste as defined in 10 CFR Part 61.55, but not the threshold for high-level waste, transuranic waste, spent nuclear fuel, or byproduct material specified as uranium or thorium tailings and waste.

Appendix (Continued)

- High-Level Waste HLW) - As defined by the Nuclear Waste Policy Act, (1) the highly radioactive material resulting from the reprocessing of spent nuclear fuel, including the liquid waste produced directly in reprocessing and any solid material derived from such liquid waste that contains fission products in sufficient concentrations; and (2) other highly radioactive material that the Nuclear Regulatory Commission, consistent with existing law, determines by rule to require permanent isolation.

- Low-Level Waste (LLW) - Radioactive waste not classified as high-level waste, transuranic waste, spent nuclear fuel, or byproduct material specified as uranium or thorium tailings and waste. All low-level waste exists in one of three classes, A, B or C as defined in 10CFR61. Most low-level waste (classes A and B) is short-lived and has low concentrations of radioactivity.

- Mixed Waste (MW) - Waste that includes both radionuclides and hazardous constituents.

- Naturally Occurring Radioactive Material (NORM) - Material that occurs in nature. NORM is a subset of NARM.

- Naturally Occurring and Accelerator Produced Radioactive Material (NARM) Radioactive waste consisting of two distinct types: Naturally occurring radioactive material (NORM), plus activation products produced from the use of accelerators.

- Site - A contaminated or potentially contaminated site is a discrete, physically separate parcel of land containing or potentially containing radioactive materials in concentrations above those naturally occurring.

- Source Material - (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by one-twentieth of one percent (0.05%) or more of: (i) uranium, (ii) thorium, or (iii) any combination thereof. Source material does not include special nuclear material.[24] Basically this means ores or material containing uranium or thorium at a concentration of greater than 0.5%.

- Special Nuclear Material - (1) Plutonium, uranium 233, uranium enriched in the isotope 235, and any other material which the Commission determines to be special nuclear material; or (2) any material artificially enriched by any of the foregoing but does not include source material.[23] Basically this means plutonium, uranium 233, or uranium enriched in uranium 233 or 235.

- Spent Fuel - Nuclear fuel that has been permanently discharged from a reactor after it has been irradiated.

Appendix (Continued)

- Transuranic Waste (TRU) - Radioactive waste that contains more than 100 Nci/g of alpha-emitting isotopes with atomic numbers greater than 92 and half-lives greater than 20 years.

- Uranium Mill Tailings - The material left over from the conversion of uranium ore to yellowcake.

- Yellowcake - A uranium-oxide concentrate that results from milling (concentrating) uranium ore. It typically contains 80 to 90% U_3O_8.

- Vicinity Properties - Properties off-site from uranium mill sites that have been contaminated either through the direct use of uranium mill tailings in their construction or by windblown particles.

- Surplus Facilities Management Program (SFMP)[HR-16] - Until recently, SFMP had been a separate and distinct program. Currently it is part of the Environmental Restoration Program's Decontamination and Decommissioning Division. It is included here under its former title because it would have been conspicuous by its absence.

  Underway since 1978, SFMP was decontaminating about 30 radioactively contaminated sites that have been declared surplus to government needs. To avoid double counting, these sites have not been included in the ER (Remedial Action) segment discussed above. SFMP sites included such installations as power and research reactors, fuel reprocessing plants, laboratories, storage tanks, stacks, pipelines, waste treatment systems, solid waste disposal sites, ponds, ditches, and areas contaminated by uranium and thorium mill tailings.

  Residual radioactivity at such a diversity of sites can encompass everything from spent fuel, contaminated storage tanks and uranium mill tailings to general laboratory waste (hoods, vents, glove boxes) and waste burial grounds. The nuclides present depend upon the specific type of site being discussed.

- The Uranium Mill Tailings Remedial Action Program (UMTRAP) - The program includes remedial actions on 24 inactive uranium mill tailings sites and vicinity properties. As of July 1990, over 12,000 vicinity properties have been evaluated, 5014 of which will undergo some form of remediation. Of these, 4455 are associated with Grand Junction, Colorado. Currently, 5039 sites and vicinity properties are being remediated under UMTRAP.[HR-20]

2.1.6 Department of Health and Human Services (DoH&HS)[7,40]

The DoH&HS operates the National Institutes of Health (NIH) in Bethesda, Maryland. The research sites at NIH include several accelerators, however, the combination is

considered as one site at this time pending receipt of additional information. The primary contaminants consist of targets or material struck by the accelerator beam, beam stops, pipes, shielding materials, vaults, and soil surrounding the underground storage vaults.

In addition to the NIH, the DoH&HS is responsible for 45 other sites located in 24 states, Puerto Rico and Washington, D.C. These sites consist mainly of research centers managed by the Food and Drug Administration and the Center for Disease Control, and branches of the Public Health Service.

2.1.7 Department of Interior (DoI)[7,40]

Three inactive uranium mill sites have been identified on DoI land and are under the cognizance of the Bureau of Land Management. These sites are not included in the DoE UMTRA Program. The DoI, through the U.S. Geological Survey, also operates a Triga reactor at its site in the Federal Center in Denver, Colorado. In addition, the DoI is responsible for 84 other sites including those managed by the Bureau of Indian Affairs, Land Management and Reclamation, the National Park Service, and the Fish and Wildlife Service, most of which use sealed source radioactive devices. All told, the DoI has responsibility for 88 sites located in 35 states and Puerto Rico.

There is also residual radioactivity at the DoI Albany site, managed by DoI's Bureau of Mines, which is listed as a FUSRAP site. Several other Bureau of Mines sites are also FUSRAP sites due to early involvement in the Manhattan Project.[7]

2.1.8 Department of Justice (DoJ)[40]

The Department of Justice operates 4 sites, 2 in Virginia and one each in Puerto Rico and Washington, D.C. These include offices of the Drug Enforcement Agency, the

Federal Bureau of Investigation, and the Institute of Forensic Sciences. Such sites include research areas and utilize measuring devices containing radioactive materials. Residual radioactivity is expected to consist of typical lab wastes (vents, gloves, coats, etc).

2.1.9 Department of Labor (DoL)[40]

The Department of Labor is licensed to possess nuclear materials and thus is likely to own or manage potentially contaminated sites. Through the Mine Safety and Health Administration and the Occupational Safety and Health Administration, the DoL has a total of 7 sites in 6 states under its jurisdiction. These sites utilize various measuring devices with sealed sources and typical lab equipment. Minimal residual radioactivity is expected.

2.1.10 Department of Transportation (DoT)[40]

The Department of Transportation is responsible for 15 sites located in 10 states. Included are sites of the Maritime Administration, the Federal Highway Administration, and various U.S. Coast Guard Cutters. Such sites utilize various research labs and measuring devices with sealed sources. Minimal residual radioactivity is expected due to the nature of the materials used.

2.1.11 Department of the Treasury[40]

The Department of the Treasury is responsible for 3 sites in 2 states and Washington, D.C. These sites include an office and laboratory of the U.S. Customs Service and a Bureau of Alcohol, Tobacco, and Firearm's site. Minimal residual radioactivity is expected since the materials in use, typical lab supplies and measuring devices, have a low likelihood of releases from their sealed sources.

2.1.12 Environmental Protection Agency (EPA)[7,28,40]

2.1.12.1 Active Sites. The EPA manages a laboratory in Montgomery, Alabama, where surplus Ra-226 sources were stored at one time. The EPA also has a laboratory in Las Vegas, Nevada where a drum of uranium mill tailings was stored.

Residual radioactivity at these EPA sites is in the form of uranium mill tailings as well as soil, equipment, piping or clothing contaminated from the leaking Ra-226 sources.

The EPA also operates 26 other sites located throughout 20 states. These sites encompass various regional offices, the National Enforcement Investigations Office, research labs, and the Toxicant Analysis Center in Mississippi. Contaminants would depend upon the specific type of site in question, with typical lab waste (e.g., gloves, hoods, coats, etc) most likely present.

2.1.12.2 Superfund (Inactive Sites). Under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), EPA has the authority to require cleanup of most radiological releases from private and Federal sites. Not included are UMTRA Program sites and, as a matter of policy, current NRC license holders.

As of January 1991, 45 sites have been proposed for the National Priority List (NPL). By definition some of these sites may be duplicates of others listed in Exhibits 2-1, 2-7 and 2-8 (e.g., Rocky Flats - Weapons Production/Testing, Weldon Springs - Surplus Facilities Management Program, Hanford - DoE Waste Management Office/ Active Sites/Diversified Labs). To avoid double counting, these 45 Superfund sites were not included in the totals.

2.1.13 Government Services Administration (GSA)[7,9,40]

Prior to 1979, the GSA was responsible for managing the National Stockpile Storage Sites of strategic materials. With the formation of the Federal Emergency Management Agency (FEMA) in 1979, responsibility for the stockpiles was given to FEMA, but GSA still retains responsibility for management of the stockpiles. The stockpiles include ores of thorium, chromium, copper, cobalt, magnesium, zirconium, and other minerals. These ores are often associated with elevated concentrations of thorium and uranium. The number of sites in this category number 111. It is not known how many sites contain ores with elevated concentrations of radioactivity. The materials are contained at 29 GSA depots, 34 military depots, 14 other government depots, and 35 plants and other sites, including one office located in Washington, D.C.

Residual radioactivity at the stockpiles of strategic materials are similar to that at a uranium mill. The primary concern is contamination of soil and equipment. Primary nuclides of concern are radium, uranium and thorium.

2.1.14 National Air and Space Administration (NASA)[7,40]

NASA previously operated three reactors at its Cleveland and Sandusky, Ohio sites and an accelerator at its Cleveland site. Residual radioactivity at NASA sites is likely to be similar to that at a typical test reactor site. Waste storage rooms, hot cells, core structural and shielding components and piping, among others, are all possible sources of residual radioactivity. The primary nuclides present would be Co-60, Zn-65 and Nb-94.

In addition to the sites noted above, NASA operates 9 other complexes in 8 states. These include various space and flight centers, research centers and offices. Contaminants would vary depending upon the site.

2.1.15 Postal Service (PS)[HR-28]

The Postal Service owns a site in Boulder, Colorado which it believes is contaminated with mill tailings. Since this is an active site, it is not included under the UMTRA Program.

2.1.16 Tennessee Valley Authority (TVA)[7,40]

TVA operates several power reactors, owns an inactive uranium mill and is involved in the phosphate industry. A total of 22 sites have been identified in 3 states, the majority of which (13) are located in Tennessee. To avoid double counting, the reactors are not included in the Section 2.2.4 totals (Nuclear Power Reactors), and the phosphate sites are not included in the Phosphate Production Plant totals in Section 2.3.1 (Manufacturing). Since the uranium mill is not part of UMTRAP, it is included in TVA's total.

Residual radioactivity at TVA sites is varied depending upon the type of operation. Mill tailings, phosphogypsum piles and typical reactor contamination (e.g., shields, structural supports, labs, etc.) are included, as well as the radionuclides associated with those type of sites (e.g., uranium, thorium, Co-60).

2.1.17 Veterans Administration (VA)[7,40]

The VA is responsible for approximately 121 sites that may require D&D, including a Triga reactor at the Omaha, Nebraska VA Hospital and an accelerator at the VA Hospital in Minneapolis, Minnesota. It is assumed that the VA operates other accelerators and radiation therapy sites although how many could not be determined from the readily available reference material. For example, the Bureau of Radiological Health is responsible for long-term storage of radium needles.[HR-8]

VA sites would likely have residual contamination typical of reactors and accelerators. Structural supports, beam targets, shielding, and lab waste are all possible sources at these sites. Nuclides of concern include Co-60 and Fe-55.

2.1.18 Other Federal Agencies[7,40]

A search of readily available reference material indicates that the Small Business Administration does not have any known sites contaminated with radioactivity. Information on the Central Intelligence Agency was not available.

It is likely that most, if not all, sites owned or managed by all Federal agencies use sealed radioactive sources in smoke detectors, level gauges, and so on. However, unless the sources are cared for improperly, they are not expected to be a source of residual radioactivity.

For more information, refer to the material entitled "Manufacturing Plants" in Sections 2.2.2 and 2.3.1.

2.2 NRC/AGREEMENT STATE SITES

Sites within this category consist of a portion of what is commonly referred to as the "nuclear industry", i.e., those civilian nuclear energy activities that require a comprehensive regulatory program to assure that they will be conducted in a manner that will protect public health and safety. Non-DoE Federal sites also require NRC or Agreement State licenses for possession of radionuclides. All sites listed below are, or have been, in possession of a NRC or Agreement State license in the conduct of their activities.

Except in a regulatory sense, the sites listed are not the direct responsibility of the NRC/Agreement States; actual responsibility resides with the individual licensees.

Accordingly, and to avoid double counting, Federal sites issued an NRC license are listed in Section 2.1 only and not repeated in this section.

The number of sites identified as NRC/Agreement State licensees totals almost 19,000 from the references reviewed. Since identifying and listing each individual licensee would serve no useful purpose with respect to the study, the sites are grouped for convenience as shown in Exhibit 2-7.

2.2.1 Medical Sites[16,36,37,39]

Two categories of medical sites were identified and are described below: Hospitals and Medical Centers, and Nuclear Pharmacies.

- Hospitals and Medical Centers - Typical sites may contain accelerators and use radionuclides and radionuclide devices in the diagnostics and treatment of patients. Of these, as many as 100 institutions may operate incinerators used to reduce the volume of low-level waste.

  There are over 5600 sites in this category. Additionally there is at least an equal number of medical support sites and functions (e.g., nuclear medical vans, veterinary sites, etc.) that are licensed by, or registered with, the States. Insufficient information exists on these activities at this time to include them in this report.

  Residual radioactivity at hospitals and medical centers is expected to take the form of lab bench tops, cabinets, vaults, piping, vents, etc., as well as shielding and other materials associated with the use of accelerators. These sites are not listed individually due to the very large number and relatively minor residual radioactivity expected.

Exhibit 2-7

Number of NRC/Agreement State Licensed Sites with Potential Residual Radioactivity, by Site Type and Location (1,2)**

SITE TYPE	TOTAL	EPA REGION 1						EPA REGION 2				EPA REGION 3						EPA REGION 4								EPA REGION 5					
		CT	ME	MA	NH*	RI*	VT	NJ	NY*	PR	VI	DE	DC	MD*	PA	VA	WV	AL*	FL*	GA*	KY*	MS*	NC*	SC*	TN*	IL*	IN	MI	MN	OH	WI
MEDICAL SITES																															
Hospitals/Medical Centers (3)	5721	73	31	123	36	24	16	161	262	39	1	16	26	116	305	112	48	112	405	181	83	98	135	60	160	225	121	251	56	229	83
Nuclear Pharmacies	116	3	1	1	-	-	-	3	-	1	-	-	-	4	7	2	-	3	9	2	1	1	2	-	3	4	2	4	2	7	2
MANUFACTURING PLANTS																															
Rad Devices/ Products (4)	9511	-	31	230	46	35	3	62	316	-	-	5	-	355	130	40	-	280	500	282	223	197	20	139	254	610	77	-	44	-	217
Radio-Pharmaceutical/Mat.	679	25	4	47	1	2	3	52	25	5	1	3	-	15	45	13	3	2	35	7	6	4	10	2	11	62	13	19	13	45	11
Radioactive Sealed Source	17	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	1	-
NON-DEFENSE RESEARCH LABS	2613	36	21	68	26	10	12	46	137	20	2	14	19	62	95	52	20	41	99	58	34	24	67	75	56	129	39	96	37	75	50
NUCLEAR POWER REACTORS (5)	110	4	1	2	1	-	1	4	7	-	-	1	-	3	9	4	-	-	5	4	-	1	5	7	-	13	-	5	3	2	3
NUCLEAR RESEARCH & TEST REACTORS	71	-	-	1	-	-	-	1	4	-	-	1	3	3	6	5	1	-	-	2	-	-	2	-	1	2	-	-	-	7	1
URANIUM FUEL CYCLE SITES																															
Milling	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conversion	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Enrichment (6)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel Fabrication	11	1	-	-	-	1	-	-	-	-	-	-	-	-	1	1	-	-	-	-	-	-	1	1	2	-	-	-	-	-	-
Fuel Reprocessing (7)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WASTE MANAGEMENT																															
Processing/Treatment	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-
Spent Fuel Storage	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Disposal	16	1	1	1	-	-	-	1	1	-	-	-	-	-	1	-	-	-	-	-	-	-	1	1	-	1	-	1	-	-	-
TOTALS: STATE	18902	143	90	473	110	72	35	330	752	65	4	40	48	558	600	229	72	438	1053	536	347	325	243	285	489	1048	252	376	155	366	367
REGION	18889						923				1151						1547								3716						2564

* Agreement State

** Numbers in parentheses refer to notes on page 42.

Exhibit 2-7 (Continued)

SITE TYPE	TOTAL	EPA REGION 6					EPA REGION 7				EPA REGION 8						EPA REGION 9						EPA REGION 10			
		AR*	LA*	NM*	OK	TX*	IA*	KS*	MO	NE*	CO*	MT	ND*	SD	UT*	WY	AS	AZ*	CA*	GU	HI	NV*	AK	ID*	OR*	WA*
MEDICAL SITES																										
Hospitals/Medical Centers (3)	5721	102	137	33	68	503	45	85	117	38	61	24	30	13	27	18	-	78	529	1	20	25	8	22	53	96
Nuclear Pharmacies	116	1	2	-	2	12	1	2	3	1	1	-	-	-	2	-	-	3	15	-	1	1	-	-	1	4
MANUFACTURING PLANTS																										
Rad Devices/ Products (4)	9511	135	275	219	290	1032	126	163	21	98	355	-	77	-	163	250	-	205	1354	-	-	85	21	88	213	245
Radio-Pharmaceutical/Mat.	679	2	12	4	9	29	6	2	19	-	6	3	1	2	5	1	-	15	51	-	2	2	-	8	5	11
Radioactive Sealed Source	17	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NON-DEFENSE RESEARCH LABS	2613	18	35	32	31	131	53	39	51	22	67	16	16	10	30	7	1	41	281	1	14	18	11	24	37	107
NUCLEAR POWER REACTORS (5)	110	2	2	-	-	4	1	1	1	2	1	-	-	-	-	-	-	3	6	-	-	-	-	-	1	1
NUCLEAR RESEARCH & TEST REACTORS	71	1	-	-	2	1	-	1	1	-	-	-	-	-	-	1	-	-	22	-	-	1	-	-	1	-
URANIUM FUEL CYCLE SITES																										
Milling	33	-	-	6	-	3	-	-	-	-	8	-	-	1	4	9	-	-	-	-	-	-	-	-	-	2
Conversion	2	-	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Enrichment (6)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel Fabrication	11	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-	-	1
Fuel Reprocessing (7)	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WASTE MANAGEMENT																										
Processing/Treatment	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Spent Fuel Storage	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Disposal	16	-	-	-	-	1	-	-	-	1	-	-	-	-	-	-	-	-	1	-	-	2	-	-	-	1
TOTALS: STATE	18902	261	464	294	403	1716	232	293	214	162	499	43	124	26	231	286	1	345	2260	2	37	134	40	142	311	468
REGION	18889					3138				901						1209						2779				961

Exhibit 2-7 (Continued)

NOTES:

(1) Dashes signify either that no State-specific data were available, that no rational basis existed for placing sites within specific States, or that no site is located within the State.

(2) In instances where information was not available on location, the sites were included in the "Total" column. Consequently the two numbers shown at the bottom of the "Total" column will not match until all State data can be obtained.

(3) Totals do not include about an equal number of nuclear medical vans, veterinary sites, etc, licensed by or registered with the States. The number of sites could not be determined from readily available information.

(4) The total represents a combination of NRC/Agreement State and State licensees because, for the most part, available information would not allow segregation.

(5) Includes plants under active construction as of 12/88. Does not include the TVA units which are listed in Exhibit 2-1.

(6) Included under DoE Materials Production, Exhibit 2-1.

(7) Included under DoE Waste Management Operations, Exhibit 2-1.

- Nuclear Pharmacies - Typical sites act as distributors of products between radio-pharmaceutical manufacturers and users, e.g., hospitals and medical centers. These sites utilize predominantly isotopes with short half-lives, with long-lived isotopes used to a lesser extent. Those nuclear pharmacies located within the confines of hospitals and universities are not included in this category to preclude double counting.

  Typical residual radioactivity would take the physical form of fume hoods, filters, ductwork, and miscellaneous supplies, trash, and cleaning solutions.

2.2.2 Manufacturing Plants[10,16,22,29,31,36,37,39]

Three categories of manufacturing sites were created to capture the diversity of ongoing activity: Radiation Device and Consumer Products, Radio-Pharmaceutical/Materials, and Radioactive Sealed Source. These categories are described below.

- Radiation Devices and Consumer Products - Typical sites are involved in the production of products that use sealed sources, such as self-luminous products (e.g., emergency lighting signs). There are approximately 9500 sites in this category. This figure is believed to be a slight over-estimate because it reflects the total number of industrial licensees, including State licensees. Because there was no convenient method to distinguish NRC/Agreement State licensees from State licensees, the total number is included in Exhibit 2-7 and omitted entirely from Exhibit 2-8.

  Residual contamination at these sites is associated with the release of the radioactive materials, such as tritium or krypton 85, from the sealed sources.

- Radio-Pharmaceutical/Materials - Typical sites label compounds in batches, with each step in the process usually handled in a separate enclosure. The sites may

contain numerous labs for the different isotopes used and products manufactured. There are approximately 680 sites in this category.[10]

Residual contamination is expected to reside in the form of lab bench tops, hoods, vents, filters, floors where spills have occurred, and other lab equipment.

- Radioactive Sealed Source - Typical sites manufacture sources to be used as reference standards, therapy units, and gamma irradiation sources, among others. These sites usually utilize long-lived isotopes and/or isotopes with high activities. Eleven active sites have been identified, although at least seventeen are known to have been operating at one time. It is not known if the six outstanding facilities have been released for unrestricted use after decommissioning, are in the process of being decommissioned, or were found not to be contaminated at all. The exact number and distribution of these manufacturers could not be determined from the available reference material.[16,29,31]

  Residual radioactivity takes the form of hot cells, remote handling devices, vents, and surfaces as a result of spills.

2.2.3 Non-Defense Research Laboratories[11,16,36,37,39]

These sites can be divided into three categories of laboratories: those that use primarily sealed sources and/or low quantities of unsealed radioactive materials; those that use high-activity sealed sources; and those that use large curie quantities of radionuclides, some of which are long-lived in unsealed form. There are over 2500 sites in this category.

The residual radioactivity ranges from minimal, requiring disposal of small quantities of radioactive materials, to that requiring major decontamination, including removal of laboratory equipment, components, and structures.

2.2.4 Nuclear Power Reactors[15,16]

This category consists of light-water reactors used in the production of commercial electrical power. Typical complexes consist of reactor, containment, cooling and power generation components. Not counting the 9 Tennessee Valley Authority units already included in Section 2.1, there are 110 sites of this type in the United States either shutdown, in operation, or under active construction. Less than a half dozen are planned to undergo D&D in the near future.

Concerns include long-lived radionuclides from activation and fission products resulting in residual radioactivity of relatively large quantities of piping, hardware and concrete.

2.2.5 Nuclear Research and Test Reactors[12,16]

This category consists of non-power reactors licensed by the NRC for medical therapy and research and development. There are approximately 71 sites of this type, including several owned by Federal agencies (e.g., NASA and VA). The sites vary in size, type, and complexity.

Residual radioactivity occurs in structural components (e.g., beam tubes, reactor tank walls), storage areas, and laboratories, among others.

2.2.6 Uranium Fuel Cycle Sites[9,16,31]

- Milling - Milling sites consist of those currently under license by NRC (active) and inactive (UMTRAP) sites being remediated by the DoE. This section discusses the active mills. Inactive mills are discussed in Section 2.1.5.2. Four types of mills exist: conventional, heap-leach, by-product recovery, and solution mining. Milling preconcentrates mined ores to minimize transport and chemical extraction costs, typically by crushing the ore, leaching the uranium from the ore, and

recovering the ore from the leachate. The end product is called "yellow-cake". Of the 33 sites of this type, four were in operation as of the end of 1988.

Mill wastes, called "tailings", are predominantly composed of uranium-238 and its decay products and discharged to a mill waste pond or tailings pile. Additional residual radioactivity includes soil and building materials, and "vicinity properties."

- Conversion - Conversion sites process yellow-cake to a level of purity necessary for reactor fuel element manufacture. The end product is uranium hexafluoride (UF_6). Wastes include the fluoride waste lagoons and solid waste burial grounds. Some contaminated waste is expected from process equipment, rubble, and building materials. There are two operating sites in this category.

- Enrichment - Enrichment is the process of increasing the percentage of the fissile uranium isotope, uranium 235, from 0.7% up to about 3.5%, or higher to fulfill military requirements. Enriched uranium is used for weapons production, commercial and Navy nuclear reactors, test and research reactors, and plutonium production reactors. There is very little information on existing residual radioactivity at these sites, although additional information is being compiled under ongoing DoE programs. There are three enrichment sites included under the DoE category of Waste Management Operations, Materials Production, Section 2.1.5.1.

Radioactive materials are present at waste burial sites and waste lagoons. In addition, residual radioactivity is associated with process equipment, concrete rubble, and building materials. The primary contaminant is uranium (as a hydrolyzed UF_6), possibly with low levels of transuranics.

- Fuel Fabrication - The fuel fabrication process converts uranium hexafluoride to a ceramic oxide by reaction with steam and hydrogen in kilns. Nuclear reactor fuel

can be a uranium metal, uranium oxide or a uranium-plutonium oxide (mixed oxide). Uranium oxide is the predominant fuel form. Ceramic grade powder is compacted into pellets, sintered, and filled into zircoloy or stainless steel tubes, that are then welded and assembled to make fuel elements. There are 11 sites in this category, four of which manufacture fuel for research and Navy reactors (i.e., non-light water reactors).

Wastes are expected to consist of burial sites, waste lagoons (calcium fluoride containing uranium) and waste from process equipment, concrete rubble and building materials. Mixed oxide sites contain plutonium and other transuranics.

- Fuel Reprocessing - Fuel reprocessing typically consists of a solvent extraction process that dissolves spent fuel, separates out useable material, and purifies and stores resulting uranium and plutonium products. There are three sites in this category, though only one has ever reprocessed fuel. The one site, West Valley, is included under the DoE category of Waste Management Operations, Miscellaneous, Section 2.1.5.1.

The residual radioactivity concerns are those associated with the high curie content remaining after mechanical and chemical decontamination of the fuel storage area, main process building, tank farm and low-level radioactive waste treatment systems.

2.2.7 Waste Management[9,13]

- Waste Processing/Treatment - These sites are relatively new and consist typically of waste compaction and/or incineration. There is one incineration site in this category. The number of treatment sites could not be determined from the reference material.

Residual radioactivity is expected to include handling equipment, storage areas for incoming material, and loading areas for material being transported off-site. If labs are present, the typical laboratory residual radioactivity (i.e., hoods, glove boxes, bench tops) would also be present.

- Spent Fuel Storage - This category is defined as all sites storing spent reactor fuel not integrated within a reactor site, i.e., away-from-reactor storage. At-reactor storage, whether wet or dry, is considered part of a nuclear power plant site and not counted separately in Exhibit 2-7. There are two sites in this category, although the location of the future DoE Office of Civilian High Level Radioactive Waste Monitored Retrieval Storage facility is not known at this time.

  A typical site contains shielding, cooling and clean-up components. Contaminated materials are expected to include piping, equipment and some concrete. Additional radioactive wastes are expected to include wet and dry solid wastes from the decontamination process. Residual radioactivity from at-reactor spent fuel storage is considered part of a nuclear power plant site.

- Disposal - These sites consist of two basic types: commercial sites designed to accept low-level wastes, and non-defense Federal sites. The Federal disposal sites handle high, low and transuranic radioactive wastes, although most Federal facilities ship their LLW to the commercial sites. In addition to currently operating low-level waste disposal sites, the list includes 11 potential low-level waste compact sites. There are 16 sites in this category.

  Most burial sites are considered to be part of the waste disposal solution and do not need to be decontaminated themselves. However disposal site surface structures will require decontamination at the time of site closure. Additionally, various sites already decontaminated were part of what is now called surplus facilities and may require additional remediation since standards have changed.